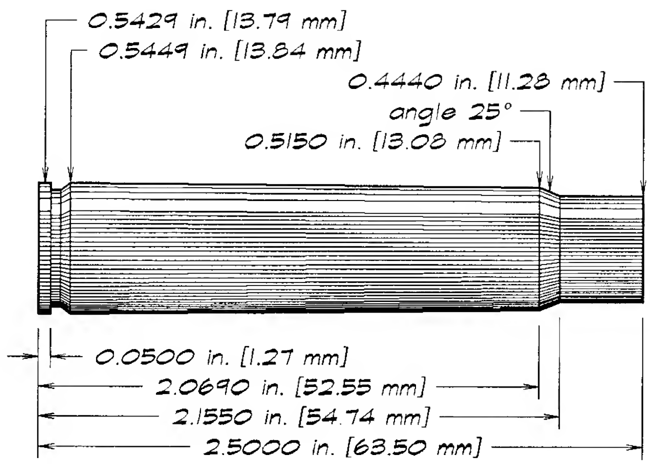
Ken Howell

.416 Howell (designer's specs)



solid:
1,050 gr brass
123 gr water

.416 bullet displaces
34.37 grains per inch.

Anneal neck and shoulder of .404 Jeffery brass. Form in RCBS .416 Howell form-and-trim die. Ream inside neck with RCBS neck-ream set. Trim to 2½ inches and deburr. Fire-form with inert filler.

designing and forming CUSTOM CARTRIDGES for rifles and handguns

THE INTERNATIONAL CARTRIDGE ARCHIVES

Next in this series:

loading and testing
CUSTOM CARTRIDGES
for rifles and handguns

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CUSTOM CARTRIDGES
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designing and forming CUSTOM CARTRIDGES *for rifles and handguns*

CUSTOM CARTRIDGES • VOLUME ONE •

fondly and gratefully
dedicated
to

Fred Huntington
who began so much more than he could've foreseen — all of it good (well, most of it, at least)

Bill Keyes
who kept up the great custom-die work that has made so many good custom cartridges possible

and the
captains and crew at RCBS
past and present, who have helped these two fellows and what they did look so good.

Foreword

Eureka!

EACH TIME a new book purporting to provide handloaders, wildcatters, and collectors with dimensioned drawings of cartridges has appeared, my hopes have been raised. Is this the ultimate source of reference on the subject? Are the drawings to scale so we can visualize the cartridges? Are the measurements accurate and dependable? Is the book complete, and if not, what has been left out? Sadly, all too often I've been forced to fault previous sources for one or more of these reasons.

One noted tome on cartridges contained a number of erroneous dimensions, raising doubts as to its reliability, while the not-to-scale drawings in another source are derelict in not giving readers a true picture of cartridges' comparative size and shape, even failing to include some factory rounds.

The problem in amassing such a compendium of cartridge data is first of all the immense expenditure of time and effort (and thus economics) involved in its assembly, verification, and presentation. Just listing the many hundreds of cartridges is challenging. I recall the inimitable firearms writer Warren Page once asking how I found the time to devote to experimental handloading and test firing. The answer, of course, lies in the other half of the equation I'll term dedication. The author of such a book must be totally committed to its accuracy, completeness, and graphic art display, however many additional hours those may take and whatever the effect on profitability may be.

Having known author Ken Howell for many years as correspondent, fellow handloader, editor, and friend, I was confident he possesses these necessary traits and abilities. Now, after examining prepublication sample pages of this great work, I'm convinced we may at last exclaim, "Eureka!"

Dr Howell's penchant for accuracy and detail is exemplified by his twin credos *Is it right?* and *"Good enough" isn't.* This book exemplifies his commitment.

Ken Waters

Preface

Thanks! I needed that.

ANYBODY WHO knows me can tell you I don't know enough about cartridges to do a book like this all by myself. I do know enough, though, to ask for help from those who know what I don't. All but a few of those I've asked for help have come booming through with it, leaving me with not much more to do than the chore of putting it all together in decent shape.

I can't even claim the book was my idea in the first place. I'd never have thought of doing it if my old friend Buzz Huntington hadn't asked me to take it on. So a large part of the credit for it has to go to Buzz, who has also helped me keep it square, plumb, and level by confirming or correcting the dope in the paragraph under each cartridge drawing.

Second only in the chronology of his involvement and in paragraph order here is another old friend — Bill Keyes, the *majordomo* of the RCBS custom-die shop since the reign of RCBS founder Fred Huntington. Bill has also pored over proof copies of all but a few of my cartridge drawings to make sure the paragraph under each drawing is right.

Cartridge designer Ken Waters and ballistician Homer Powley graciously read drafts of the text chapters, looked over samples of the chapter illustrations, and showed me how to pound out the dents and polish out the blemishes they spotted. Nobody putting a book like this together could find better mentors and helpers than these fellows.

I couldn't have made all these cartridge drawings and chapter illustrations all by myself, either. I took courses called "mechanical drawing" in high school, "drafting" in the navy, and "engineering drawing" at Auburn — then never did enough of it to develop more than average ability. If I'd been the best draftsman in the business, I couldn't have hand-drawn the number of cartridges I've drawn in so short a time for this book.

The cartridge drawings and chapter illustrations are really the work of my awesome partner, AutoCAD Release 12. This impressive software is a huge and powerful program, capable of worlds more than I've asked of it. Using it to make cartridge drawings is somewhat like using the old Goodyear blimp hangar to keep my lawnmower dry. It's not just a drafting program but the best *designing* program there is, chockful of ways to plug in one *what if* after another easily, to see how they work. No one who designs or draws cartridges should try to slog along without using AutoCAD.

Several good friends promised help that as things turned out, they couldn't provide. I'm as grateful to them as if they had been able to give all the help they promised and intended to give. Their interest, their desire to be part of the job,

and most of all their encouragement are beyond price or payment. Gratitude permeates my soul so thoroughly, I appreciate the help offered by a few friends who — although they know nothing at all about writing, editing, publishing, drawing, ballistics, or cartridges — jumped right in with detailed advice on how I ought to do all the chores of putting this book together.

Cooperation from both industry figures and private individuals has been mostly extraordinary, marred mainly by the practical impossibility of acquiring dependable, authentic dimension data from everyone who has designed or developed a custom cartridge, and marred only a little by several individuals' laxity with their specifications and records. Only one well known industry figure just flat said no, and I was able to get the specs for his father's cartridges from other sources anyway.

One question or assumption is sure to occur to some readers and will probably lead to a raft of rumors if I don't put this on the record now: no company or corporation, large or small, put any money into The International Cartridge Archives or my preparation of this book. I'd've loved some dollar help along the way but didn't know how to angle for it, even if I'd wanted to.

Thanks is a word that's easy enough to spell and pronounce but least satisfactorily expressive when you need it most and feel it most intensely. Of the hundreds of prefaces I've read, none expressed the gratitude I want this one to convey. So my acknowledgements here have to include a few details hitherto unknown to preface format.

I owe so much to such a distinguished multitude that my debt of gratitude would rival the federal debt if it were expressible in dollars. One regret is greater than my frustration at the inability to thank everyone adequately — the regret that so many are no longer around to see that their graciousness toward me may not have been a total waste of their time. The roots of this book go deep into years and associations past.

Even if the roster were only half as long, I'd have too little space here to list the individual debts I owe all these people. Also, there are all those who sent me stuff they knew I could use but didn't identify themselves as the senders. I suspect, judging from the nature of some of this anonymously given material, that confidentiality is worth a hundred bucks a minute to these helpers, so I don't think I should mention any of their contributions specifically anyway.

Then there are a few contributors whose identities I know, who don't want me to list their names or contributions here. They want confidentiality for no suspicious reason — just their understandable reluctance to be listed as sources of the information or other assistance they've granted me. They don't want to be swamped with requests like mine. I'm flattered as well as inexpressibly grateful for their selectively honoring me with their cooperation.

But I still haven't gotten all the data I need. Volume Two and later revisions will include new cartridges, newly discovered old cartridges, and well known oldies I've only recently gotten dependable data for. *You* can help, if you have designed a cartridge that I don't know about, or if you have drawings or specifications for someone else's cartridges. I still need authentic case dimensions for many old-time wildcats.

If you supply drawings or specifications I need for drawing more cartridges, I guarantee you I'll be as grateful as the drunk whom Mark Twain told about, who staggered home in the rain one night with the sidewalk pitching and rolling under his feet. He managed to grab the gatepost the third or fourth time it passed him, and pulled himself through the gate to find his front walk lurching as violently as the sidewalk.

He grabbed the front steps in a wide embrace after several leaps at them, crawled across his heaving porch, struggled to his feet, and after several grabs snagged the doorknob. He crawled across the living room, finally trapped the passing newel post, and pulled himself erect.

With the banisters guiding him, he crawled up the stairs, pulled himself upright, and hooked his toe under the tread when he tried to take the last step. He tumbled down the stairs, again snagged the newel post and clasped it tight to him as he looked upward and exclaimed, "God help the poor sailors out at sea on a night like this!"

I'm the one you can throw darts at if you find anything in this book you don't like. Here's a partial roster, some of the people you owe for whatever you like and find useful. (You fellows

on this list — those of you still living — know what I owe you for, and you can be sure I won't ever forget you or your help.)

I know I've overlooked somebody I meant to list, so I apologize for my leaky memory. I'll remember whom I've overlooked, two or three seconds before I open the first printed and bound copy. In Volume Two, this roster of fine friends will be more nearly complete.

Ken Alexander (CCI-Speer)
Don and Norma Allen (Dakota Arms)
Arthur Alphin (A-Square)
John Amber *
Dave Andrews
Eric Archer
Tom Ballard
Argus Barker (Monarch Tool Co)
Paul Beckstrom
Jim Bell (Mast Technology)
Bruce Bertram (Bertram Bullets)
Johnny Boberg (Sweden)
Herman Bockstruck (Winchester-Western)
Dave Brennan (*Precision Shooting*)
R J Brill (Royal Arms International)
Randy Brooks (Barnes Bullets)
Bill Brophy *
Bob Brownell *
Frank Brownell (Brownell's)
Len Brownell *
John Buhmiller *
Tom Burgess
Jim Carmichel (*Outdoor Life*)
Ralph Carter (Carter's Gun Shop)
Bill Chevalier (National Reloading Manufacturers' Association)
Dan Cooper (Cooper Firearms)
Dave Corbin
Ed Corpe
Walter Craig *
Gene Crum
Dave Cumberland (Western Scrounger)
C L Cummings
Jim Cuthbert (JGS Die and Machine)
Larry Davis
Bill Davis (Tioga Engineering)
Chub Eastman (Nosler)
Elgin Gates *
Mick Gathright
Gerry Geske (Geske Benchrest Actions)
Bill Gravatt (Sinclair International)
Tom Griffin (Lyman)
Nick Harvey (Australia)
Hugh Henriksen (Henriksen Tool Co)
Iver Henriksen *
Inge Henrikson (Sweden)
Bob Hodgdon (Hodgdon's)
Joyce Hornady *
Steve Hornady (Hornady)
Walter Howe
Carol Anne Howell *
Ben Howell (facsimile of his progenitor)
George Hoyem (Armory Publications)
Buzz Huntington (Huntington's)
Fred Huntington (founder, RCBS)
Neele Johnston (Autodesk)
Bruce Jennings
Dave & Bret Jensen
Bill Jordan
Charles Kamanski
Charles Keim
Elmer Keith *
Wyatt Keith *
Ken Kelly
Monty Kennedy *
Bill Keyes (RCBS)
Gene Koch
Dave LeGate *
Bob Lutz *
Arthur Mack
William Magee
Lowell Manley
Paul Marquart (Marquart Precision)
Judge Don Martin *
R L Matthews
Ed Matunas
Wally MacDannel
Jack McPhee *
Walt Melander (NEI Handtools)
Morris Melani
Tom Miller (Huntington's)
Greg Millin
Ole A Molvær (Norway)
Paul Moore (Magma Engineering Co)
Earl Naramore *
Guy Neill (CCI-Speer)
Ted Nicklas
George Nonte *
Ken Oehler (Oehler Research)

Clyde Oldham
Ludwig Olson
Charles O'Neil *
DeWayne Owen
Frank Pachmayr
Bobby Painter
Corey Pantuso (Freedom Arms)
Pat Payne *
Mark Pixler (Dillon)
Homer Powley
John Quackenbush
Gary Reeder
Mike Renner (Hungry Horse Books)
Dwight Sawyer
Paul Schaffer
Layne Simpson
Howard Sites *
Bill Steigers (Bitterroot Bullets)
Bill Taylor
John Tietz
Mike Venturino
Bud Waite *
Ralph Walker *
Ken Waters
Colonel Townsend Whelen *
H P White *
"Bill" Williams
Jim Wilson
Les Womack
John Wootters

—and the many other readers and friends whose questions, complaints, suggestions, puzzlements and problems have taken me deeper into the subject of custom cartridges than I ever would have gone if you all hadn't extended my interest and curiosity—

—and special thanks to all you trusting readers and dealers who, early on, have ordered copies without having seen the book. I hope this volume earns your respect, as you've earned a lasting and very special place in my heart.

Ken Howell
Stevensville, Montana
6 January 1995

Member, National Shooting Sports Foundation
Endowment Member, National Rifle Association
Honorary Member, Montana Sheriffs and Peace Officers Association

* *in memoriam*

Introduction

"How long is a .30-06?"

"HOW LONG is a .30-06?" This question from the plaintiff's lawyer sounded harmless enough. The plaintiff was suing a manufacturer for allegedly making the faulty ammunition that had caused him grievous bodily harm. I could not see how the length of a .30-06 could have any bearing on the technical aspects of the evidence I had examined. The lawyer's question was obviously a tactic. He had a trap or a cow pie ready for me to step into, because my testimony was going to make his client miss a shot at something like six million dollars unless he could make me look bad to the jury.

Ironically, he had engaged me to examine the evidence in the first place — but he hadn't liked what I'd concluded from it (that his client had been shooting handloads). A defendant's lawyer noticed he'd consulted me but hadn't listed me as a witness for the plaintiff, and subpœnaed me to take the witness stand during the defense phase. This turn of events didn't set well with the plaintiff's attorney, either.

"A loaded round, or an empty case?" I asked. The length of a loaded round, of course, would depend on the bullet in it.

"An empty case."

I explained that "the length of a .30-06 case" wasn't just one set figure. The nominal length specified in the design of the cartridge would be one figure, and the actual length of an individual specimen case would most likely be a different figure. I went on to explain that since I dealt with so many cartridges in my own handloading, in dealing with other handloaders' questions and problems, and in my writing, I couldn't rely on my slippery memory for the dimensions of any cartridge. Memory would trick me sooner or later, so I didn't dare even try to remember any case dimensions.

I described my shelf of reference books where I looked up nominal dimensions. I took a dial caliper from my attaché case—

"—and I use an instrument like this to measure the actual length of an individual case, and sometimes a micrometer to measure other dimensions of a case."

"Then you can't tell me how long a thirty aught six case is?"

"No, not just off the top of my head—"

He looked down at his notes, with a smile, to form his next question.

"—but if I remember correctly," I continued, "it's in the neighborhood of two point four nine four inches."

My reply visibly flustered him. He dropped that line of questioning and came at me from another angle. When I got back to my office, I looked up the .30-06 in a couple of handloading manuals — nominal case length, 2.494 inches. I'm sure he'd looked it up, had written that exact figure in his notes, and had built some little trap with it. I've wondered ever since what his next question was going to be.

In the decade or more since that case, I've often thought of how much longer and more detailed my answers would have had to be if he'd

gone further with that line of questioning — especially if he'd asked about the other dimensions of a .30-06 case. Many times, I've remembered how often my reference sources let me down when I searched through them for cartridge dimensions. They either didn't mention those cartridges at all or showed only some dimensions but not all I needed.

I've often thought how nice it would be if we had a reliable and comprehensive reference that clearly and consistently showed the significant dimensions of all known cartridges. Then as I began compiling and studying case dimensions for The International Cartridge Archives projects — the computer database of case dimensions and the two *Custom Cartridges* books — I learned even more about how chaotic the world of cartridge dimensions is, for anyone who wants to be able to rely on authoritatively fixed standards and final specifications. Looking for dependable cartridge dimensions is too often as frustrating as the second opinion a doctor gave a woman he'd just told she was too fat.

"If you don't mind," she huffed, "I'd like a second opinion."

"All right," the doctor answered, "You're ugly, too."

The world's treasury of cartridge information isn't as skimpy as I used to think it was. It's not too fat, but it is ugly — a chaos of gold and mud, silver and sludge, diamonds and dross. No perfect or promising solution seems workable. No perfect reference is possible. For what I have to assume are good reasons, even the standards can shift and change from year to year. This long-standing situation reminds me of the fellow who went in for a complete checkup, saying, "Doc, I never felt better in my life — and I think it's time I did!"

The best anyone can do is to rely on maximum dimensions, specifications, and measured dimensions only as firmly as their origins deserve. For these books and the cartridge database, I've tried to collect all the best and most reliable data. I've reached only a moderate plateau of success — well above the desert of hearsay and other totally unreliable data but also well below the heavens of dimension data perfectly immune from dispute. This first volume includes drawings of a dozen or more cartridges never published anywhere before, but it omits even more well known wildcats because I haven't been able to ferret out any dependable dimensions for them.

My first and most reliable level of authority, which covers regrettably few cartridges, is the set of case dimensions the Sporting Arms and Ammunition Manufacturers' Institute (SAAMI) has established as the official *maximums* for the cartridge cases its members produce. SAAMI's maximums cover only the current crop of cartridge cases made and loaded by SAAMI's member companies. Fortunately, I have two older vintages of the SAAMI maximums as well as the current set.

For the classic British hunting cartridges, I rely on two primary sources — tables of maximum case dimensions from England's Birmingham Proof House and several vintages of Kynoch drawings (some are marked *Kynoch*, and some are marked *ICI* for Imperial Chemical Industries, Metals Division, the manufacturer of Kynoch ammunition).

The German authority R Triebel, *Büchsenmachermeister* of Kaufbeuren, has published a more comprehensive set of case maximums, and I consider them as reliable as SAAMI's. Several friends in the American firearms industry have warned me that the European counterpart of SAAMI, the *Commission Internationale Permanente des Armes à Feu Portatives* (Permanent International Smallarms Commission — CIP for short), often "improves" or "refines" the maximum dimensions of cartridges covered by both CIP and SAAMI, for example. But CIP's maximum dimensions are official for a long list of cartridges, so I've relied on them to draw many of the cartridges in Chapter 6.

Next most reliable, for cartridges that have no SAAMI, Triebel, or CIP pedigree, are the dimensions specified in designers' and manufacturers' cartridge drawings, which I cherish and rely on when I can get them. Next to last in reliability are carefully measured dimensions of specimen cases, which are unfortunately only a shade more reliable than unconfirmed hearsay dimensions from hither and yon.

The dimensions of any given specimen are

variations from a set of standard, specified, or maximum dimensions, and there's no way of telling with a micrometer or dial caliper how much or in which direction a given specimen's dimensions vary from the standard, specified, or maximum dimensions.

The dimensions of an individual cartridge are practically impossible to measure accurately enough. This problem also came up during the cross-examination I mentioned at the beginning of this introduction. Crucial evidence in the case included certain imprints that toolmarks in the chamber of the subject rifle (and another rifle) had left on the burst case and the other cases later picked up at the scene. One of these crucial toolmark imprints encircled the burst case and several others, just below the shoulder.

"How far below the shoulder is this toolmark imprint?" plaintiff's lawyer asked.

"Approximately one millimeter," I said.

"Did you measure the distance below the shoulder?" he asked.

"Yes."

"What did it measure?"

"Approximately one millimeter."

"Did you record your measurement?"

"Yes."

"What did you record?"

"Approximately one millimeter."

"Do you have your notes with you?"

"Yes."

"Will you read for the jury exactly what you wrote in your notes?"

"Yes, certainly." I read aloud what I'd written in my notes. The toolmark imprint we were talking about, my notes said, encircled several of the cases I'd examined — "approximately one millimeter below the shoulder."

His exasperation was obvious.

"I'd like to get away from this '*approximately* one millimeter' if you don't mind."

"Can't do it, Counselor."

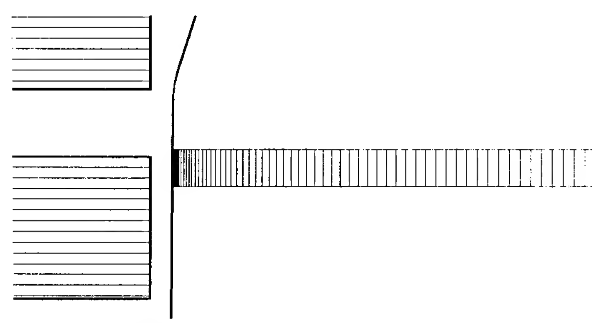
"Why not?"

"Because the shoulder isn't a sharply defined line on the case. It's a curve. And the toolmark imprint is wide enough to have a visible front edge, a middle, and a rear edge. Even if there were a sharply distinct reference line on the shoulder, the distances from that reference line to the front edge, middle, and rear edge of the toolmark imprint would have to be three separate measurements."

The precise distance between the shoulder of the case and that toolmark imprint was totally irrelevant to the significance of the evidence anyway. There was no point in measuring it to the nearest thousandth of an inch, even if I could've — which was why I noted the distance with a millimeter number instead of an inch number. Noting it as a decimal or fractional part of an inch would've implied a precision finer than I could measure, finer than was necessary.

Official cartridge drawings include the note that certain reference "dimensions are to intersection of lines." One problem with trying to measure a specimen case accurately is that these crucial lines don't intersect — usually, a curve on the case rounds off and replaces the point where two lines intersect in the drawing.

Also, the real importance of length and diameter dimensions is the way they combine to define the crucial surfaces of the case. Official drawings usually define these crucial surfaces with diameters and lengths that are independent of the obvious "landmarks" on the case, which you and I would use to determine dimensions. On a rimless necked case, the crucial surfaces are the sides of two truncated cones (also called frustums): the body and the shoulder.



The jaws of the dial caliper — shaded with horizontal lines — are exactly one millimeter apart. The toolmark imprint just below the shoulder of this .30-06 case (shaded with vertical lines) is the imprint of a wide gouge in the chamber wall. It isn't a fine line. The shoulder of the .30-06 case is a curve, not a sharp corner.
Plaintiff's counsel wasn't happy when I testified again and again that the toolmark was "approximately one millimeter below the shoulder" of the ruptured case and others. But that was as accurate as I could describe it, because that was as accurate as I could measure it — and as accurate as it needed to be, in the context of the lawsuit.

A typical SAAMI drawing, for example, defines the body surface with a diameter 0.200 inch ahead of the breech face and another diameter a specified distance farther toward the shoulder (but not quite to the shoulder). The same drawing defines the shoulder surface by specifying a diameter midway along the slope of the shoulder, a basic angle, and the axial distance from the breech face to this midslope diameter.

In the manufacture and loading of the actual case, the curve that replaces the theoretical intersection of the body and shoulder lines can be large — as it usually is on a case that's been die-formed but not yet fire-formed — or small, as it is when a high-pressure load has formed it to the sharper shoulder line of the chamber.

The basic differences between (a) specifying points and distances to define surfaces and (b) measuring distances between existing points to identify or compare cases should be obvious. The drawing specifies where a certain surface is supposed to be, to establish the design of the cartridge. When you and I measure a case, we're looking to find where certain points are, not to establish key surfaces.

Obviously, it's a world easier to specify where a point is supposed to be on the drawing than it is to measure minutely between two points that may exist only on the drawing, not on the case. The body line "intersects" the shoulder line out in space somewhere, and the shoulder line "intersects" the line of the neck somewhere down inside the brass itself.

Neither of these points gives a micrometer or caliper a sharp, clear measurement reference. In the end, the single most reliable set of dimensions for any cartridge are the properly identified standard, specified, or maximum dimensions. Whenever I can't get anything more authentic and can get a specimen to measure, I use the measurements my dial caliper gives me.

One "designer" who couldn't tell me the dimensions for any of his cartridges has minutely "corrected" my figures for the dimensions I measured from the specimens he had sent me. I put *designer* in quotes for him, because he never designed anything but merely told someone else to "neck the .xyz Magnum to .abc," without defining any other dimension, and let somebody else work out the dimensions of the chambering reamers and loading dies.

He's not alone — this is a common practice among cartridge "designers." There's nothing really wrong with the practice, certainly nothing evil or despicable about it, but there's a lot more to designing a cartridge. I'll cover this subject later, in a chapter devoted to it.

When I began these projects, I planned to rely heavily on the late David J LeGate's superb cartridge drawings for the dimensions of wildcat and obsolete cartridges not covered by the more authoritative sources. I had worked with Dave for several years and had seen how diligently he researched and measured cartridges and how carefully he drew them. I drew case after case from his figures — until I ran into one mistake after another, some of which I couldn't resolve.

Then I remembered how much Dave loved the entire business of publishing two technical firearms magazines. The office was more of a home to him than the house where he lived, and the office crew was his real family. He knew far more about magazine publishing than his job required him to know, and he pitched in to help with every kind of chore we had to do. He used to roam and chat until the heat of an impending deadline made him work hurriedly, long, and late to get his drawings done in time.

In spite of the several errors I found in his dimensions and others I suspect may be there but haven't found, I still consider Dave's cartridge drawings to be generally reliable. His long-time employer has posthumously published a book of his drawings but has regrettably left his name off the book and has even taken his neat, attractive, and unobtrusive little personal logos off all his drawings. He was a good and honest workman who deserves a lot more credit than he ever got.

I'm glad the book of his cartridge drawings is available, and I recommend it to you (Chapter 7), but I wish the cartridge drawings in it were properly acknowledged as the work of my late good friend Dave LeGate.

A couple of other able fellows took on this kind of work and left their marks long before I considered taking it on. First George Nonte's and later John Donnelly's book on cartridge conversions broke the ground and laid foundations and

formats for this kind of cartridge reference.

Donnelly built on what Nonte began, and both — by not exhausting the subject — left plenty for me to do to set mine apart as different and independent works. Nonte and Donnelly used and recommended techniques that I avoid and therefore don't recommend. Both Nonte and Donnelly recommend case modifications that scare me to shivers. Still, there's enough excellent material in both books to make them assets to the library of anyone seriously interested in the technical details of centerfire cartridges.

George was one of my staff writers when he died. As far as I knew, he was content to let his book on cartridge conversions continue to sell as it did, without any updates, corrections, or revisions. He had enough to do, without that added responsibility.

John Donnelly knew all too well how badly flawed his book is and was revising it when he died unexpectedly. He had approached me for collaboration, and we had planned a series of get-togethers that his sudden illness and death made impossible. The loss of both a friend and his revised book continues to sadden me. This regret is one reason I agreed to do these books.

Taking up Nonte's and Donnelly's baton didn't occur to me until Buzz Huntington, who manages Huntington Die Specialties next-door to RCBS in Oroville, California, suggested that I take up where Donnelly had left off. The original idea and intent were to purchase or license Donnelly's material from his widow, but we weren't able or destined to arrange a meeting.

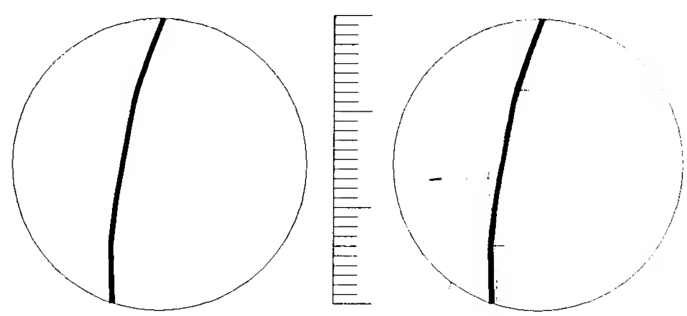
Meanwhile, I went to work gathering up all the authentic, authoritative, dependable dimension data I could beg, borrow, buy, copy, or find. I even rediscovered cartridge references I'd forgotten I had.

It soon became obvious that just as building a new house is simpler and easier than rebuilding an old one, building my own book from scratch would take less time, effort, money, and fret than working over Donnelly's material. So I decided to escape the problems of redoing Donnelly's book, built myself a more muscular computer, got a current copy of AutoCAD, and got down to business without any of the Donnelly material.

I also saw a few ways I could improve on Donnelly's presentation to make my book not only more accurate and reliable but also more readable and attractive. My book would thus be like Donnelly's in only one respect — we both cover the same basic subject, modifying cartridge cases — but with completely different styles, formats, and contents.

At the same time, I acquired a computer database of case dimensions from a fellow who had been compiling those data for thirty years or so. He had become discouraged and pessimistic about the commercial value of what he had built and didn't plan to continue trying to sell it. But he hadn't broken himself of the habit of entering new data whenever he got them. When I acquired his database, it comprised complete and partial entries for 5,339 cartridges. It included many duplicate entries, and even more entries were cartridges for which he had only a name and few or no case dimensions.

Also, he hadn't recorded, for any cartridge, several dimensions that you and I would consider mandatory. So I restructured the database, added fields for those other important dimensions, and started cleaning it up. I deleted a passel of duplications, entered a bunch of missing di-



Each circle encloses a 50x magnification of the shoulder of a .30-06 case, with the curve at the base of the shoulder flattened. In the right-hand circle, I've added helpful tiny tick marks to show where the body and shoulder lines join the curve. With the scale for a guide, can you tell where the body and shoulder lines would intersect, if you extended them?*
Each small graduation on the scale represents 0.0001 inch. Each large graduation on the scale represents 0.001 inch.
**The thirteenth teeny tick mark from the bottom.*

mensions, corrected a slew of erroneous dimensions, and added hundreds of cartridges that hadn't been included in his original database. There's still a lot more work to do on the database, but I've increased it from 5,339 cartridges to nearly 5,600 — and have a lot more to add when the pressure of the book job lets up.

Someone — maybe you — is sure to wonder why I've applied the term "custom" to cartridges. Good question. I use *custom cartridge* to include personally or privately modified cartridges, not just wildcat cartridges. A factory cartridge you handload with your own choice of bullet and powder is your custom cartridge.

A shooter may have a firearm with an obsolete, foreign, or unknown chamber, and he has to modify some known and available case to make that gun shoot. Chances are, the chamber of that gun is not a wildcat chamber — but the fellow's practical needs are exactly the same as if it were. He may just want to load Boxer-primed American brass instead of the Berdan-primed factory brass for some European standard.

I form cases for my .358 Norma Magnum — which is not a wildcat cartridge — from .300 Winchester Magnum brass for two reasons:
First: by shoving the shoulder back only as far as I want it to go, I can headspace the case on the shoulder and ignore the belt altogether — for better headspacing and longer case life.
Second: since .300 Winchester Magnum brass is appreciably longer than the .358 Norma case, I can leave the newly formed neck longer to enclose more of the bullet for better bullet pull (and therefore better performance from the powder charge), while the case remains in all other respects a .358 Norma Magnum. (And of course my chamber neck is longer to accommodate the longer case neck.) What I have isn't a wildcat cartridge, strictly speaking, but a custom cartridge. I also have a fine classic sporter (on a Mauser action) barreled for the 9x57mm Mauser but for 0.358-inch rather than 0.356-inch bullets — neither a factory nor a wildcat chamber, but a custom cartridge.

We've long distinguished some cartridges from the rest, as either *factory loads* or *handloads* (according to how they're loaded) and either *factory* or *wildcat* (according to the origin of their design and whether the manufacturers have adopted them). Neither classification nor either set of terms quite covers everything. To define and clarify the different kinds of cartridges more accurately, my personal vocabulary depends on a couple more terms. You may find them useful, too.

¤ *Factory* cartridges are sometimes factory designs, sometimes well established wildcat designs (.22-.250, .257 Roberts, .25-06, .35 Whelen, and several others), factory-loaded with limited choices of specific components.
¤ *Home-made* cartridges are home-loaded rounds assembled with the same components (and presumably deliver approximately the same performance) as factory loads.
¤ *Handloads*, factory or wildcat designs privately loaded, can be either home-made or custom cartridges.
¤ *Wildcats* are cartridges that were independently designed and — so far — not factory-loaded. Some of the best factory cartridges established their worth and their following as wildcats that proved to be so good and so popular that one after another, firearm and ammunition manufacturers simply had to cut in to get a piece of the pie.
¤ *Custom* cartridges are either factory designs or wildcats, loaded privately but not home-made duplicates of any factory cartridge.

This book is for handloaders, designers, collectors, gunsmiths, writers, editors, dealers. The basic purpose is to bring together — in a single, reliable source, in a consistent format and scale — as much authoritative, familiar, obscure, scattered, and varied cartridge-dimension data as possible, to replace or correct inaccurate information published in other references.

My cartridge drawings are meant to help shooters choose suitable extant cartridges without having to design *and finance* new ones of their own — or help them design their own, if what they want doesn't already exist.

A major aim is to make this book useful also to others who may not be shooters, designers, collectors, gunsmiths, or handloaders — historians, investigators, researchers, for example. To make it useful, I include some cartridges others would probably not include.

Let's say you have a rifle for a strange cartridge you've never heard of and can't find, and you'd like to know whether (a) you can make brass for it by modifying some other cartridge, or (b) you will have to rechamber, rebore, or rebarrel your rifle to be able to shoot it, or (c) you will have to forget about shooting that rifle.

There's no other case, let's say, you can form into the one your rifle needs. I include several cartridges you can't make from anything else, because it seems obvious to me that when you can't, it's useful to know you can't. You can drop that idea and look into other ways to make that rifle shoot.

I also include several intentional duplications — two or three drawings of the same cartridge, from equally reliable sources — to show how different authorities set down sometimes conflicting and sometimes confirming specifications for the same cartridge.

Some known duplications come from the fact that different authorities often use different names for the same cartridges. By comparing drawings, you may find that two cartridges often listed as "the same as ..." really aren't the same (even though the ammo for one works all right in the other, sometimes). You may also find that two cartridges often listed as different are really the same cartridge with two names.

I've listed the dates of the source drawings I've used for several cartridges, since even a given authority often changes its specifications. (Usually, they're minor changes). In several instances, it's interesting to note how old some "recent" cartridge really is.

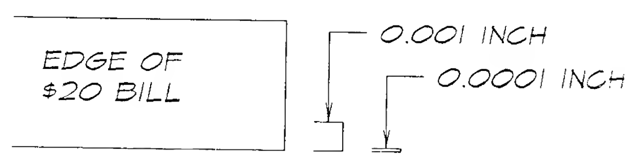
I wouldn't want to see the hot-stove circle at the gun club stop arguing about cartridges, but I hope my books will help reduce the number of the needless disputes over imaginary split hairs. There are quite enough real hairs that can stand to be split, so there's no need to make up imaginary ones to fuss about. Among honorable men, there's no market for confusion.

The classical fallacy traditionally labeled *post hoc, ergo propter hoc* (after this, therefore because of this) lives and thrives among the cartridge cranks who claim that because Mr Feral Feliner introduced his .123 Burp several years after Bob Katt designed the .123 Belch, Mr Feliner knowingly copied Katt's cartridge and tried to foist it off on an unsuspecting world, solely to get credit for designing the .123 Burp.

The fact of independent, simultaneous discoveries and creations — designs, inventions, hypotheses, and theorems developed by honest people who don't know of each other's existence or developments — are too well known for anyone to impute any low-minded motive to the mere fact that someone has presented, as new and his own, something that turns out to have existed before he created his second incarnation of it.

In collecting the source data for this book, I've come across a good many cartridges that look like twins but probably have no connection except coincidence. This month, I learned of a .411 cartridge only recently designed by a young fellow in Oregon who almost exactly duplicated a .416 I designed in 1979. He knew nothing whatever of my earlier design, so he obviously didn't "steal" it from me.

An 1873 Frankford Arsenal publication I used to own included a drawing and description of a forward-ignition system — a short, small tube that led the primer flash forward, from the primer vent through the rear half of the powder charge, to ignite the charge in its middle. That design antedated by decades some of my friends' development of exactly the same process. I'm



When you argue about — excuse me: discuss — the last thousandth or ten-thousandth of an inch in a certain case dimension, here's what you're talking about. Not as big as you thought it was, I bet. Nobody discusses the thickness of twenty-dollar bills, but there's no shortage of other hairs to split, especially among those of us who are interested in the cardinal or official dimensions of cartridges.

sure they knew nothing of its preexistence.

I'm not trying to resolve every possible question or confusion, of course.

One of my shipmates in the chow line at boot camp jumped in surprise when I poured gravy over the creamy ball I'd just clicked onto his tray from an oversize "ice cream" scoop. Then he relaxed: "Oh. Potatoes. I thought you were putting gravy on *ice cream*."

At a Winchester banquet, the fellow on my right was talking earnestly and intently to the fellow directly across the table. We had just finished the main course. Two scoops of sour cream and a spoon sat untouched in a bowl in the center of the table. I passed the bowl to my right.

"Ice cream?"

"Oh, yes. Thank you."

As he took up his interrupted discourse again, he took the bowl, set it down, picked up the spoon, dug into the sour cream, and put a heaping spoonful into his mouth. The taste of sour cream was of course a shock, and of course his response amused the others at the table. (Yes, I know: I'm a dirty dog. But it's fun sometimes, if nobody gets hurt or mad.)

I love sour cream and mashed potatoes, but the taste of either would shock me too, if I expected to taste ice cream. I hope you won't judge *Custom Cartridges* harshly for what it isn't and isn't meant to be. It isn't ice cream, sour cream, or mashed potatoes. If you don't expect it to taste like any of these, its flavor won't shock or disappoint you. It isn't and doesn't include load data, historical notes, commentary, evaluations, specifications for tooling, notes on the rifles and handguns that use these cartridges, or a set of standards for industry reference. But it's not just drawings, either. The comparatively few pages not covered by the dimensioned cartridge drawings explain a few basics of

¤ cartridge brass — what it does and how it's made,
¤ handloading good safe cartridges that aren't hard on cartridge brass,
¤ the fire and fuss inside the cartridge and the barrel between the hot flash of the primer and the powder's last gasp at the muzzle,
¤ retraining cases for duty as other cartridges, and
¤ selecting and creating your own special custom cartridge.

I hope you like this book and find it useful for what it *is*. Chapter 7, "Get other stuff somewhere else," lists several references you can go to when you want something that *Custom Cartridges* is not.

Julie Andrews, sweet enough to spread on toast, sang a charming tune in *Mary Poppins* with the line "A spoonful of sugar helps the medicine go down in a most delightful way." My mother used to insist sweetly that anything you could do sitting down wasn't work, antiseptics that didn't burn or sting didn't do anything for a cut finger, and food or medicine that didn't taste bad wasn't good for you.

By the time I started first grade, I'd had enough castor oil, quinine, iodine, overcooked collard greens and spinach, and other such face-wrinklers to last me well into the millennium if not through eternity.

Every time I start to say I wouldn't wish any of that onto anybody, I think of a couple of people I'd like to tank up with quinine or stuff full of coarse, bitter collard greens. Then I realize that if I want anybody to take anything gladly, keep it down, and come back for more, it better taste good to him.

You'll notice here and there a light tone and writing style, and some off-the-subject remarks that contrast with the no-nonsense crispness of my cartridge drawings and the technical accuracy of the text chapters. These are natural, not contrived, a little of the personal to flavor the very impersonal.

I've carefully shunned technical writers' tendency to contrive a stiff, stilted style. This isn't the right place to go into the psychological reasons for stilted writing or the discrepancies between its intents and its impacts. A light style isn't sugar, and I hope the stuff of this book isn't medicine, but adorable Julie's lyrics state the principle sweetly and succinctly. I see no point in making you have to gag it down to get the good of it. (Sorry, Ma.)

And since I don't scorn my readers or look upon you as a nameless, faceless mob to be kept beyond personal contact, I've included personal notes and information other editors would have

cut out — how the book came to be, how and why it has come to be what it is, *etc*. This has been your book since before you bought it. Some of it has to carry as much authority as a nine-to-nothing Supreme Court decision — but I hope the rest of it comes across to you more like a casual but accurate, useful conversation about technical matters between friends.

This material would be awfully dull and grey without a light personal touch here and there. I used to get complaints from readers who wanted more variety in the illustrations we used in articles and columns about powders, cartridges, handloading, *etc*. But in a reference work on cartridges, how wide a range of illustrations is possible, let alone legitimate? Consistency is vital, therefore mandatory, in the cartridge drawings. They leave no room for variety of style, angle, or scale. They all have to look like cartridges, and not like anything else. Certainly not like frogs, for example.

I don't draw frogs anymore. The last time I drew a frog (1957), it plunged me into one of the silliest dialogues of my life. My lab instructor, a usually agreeable premed student, rejected my drawing of a frog for a zoology-lab assignment:

"Not acceptable," he said.

"Why not?"

"You didn't draw it yourself."

"What do you mean, I didn't draw it myself? Who do you think drew it for me?"

"You obviously traced it out of a book."

"Show me the drawing you think I traced."

"Well, maybe you just copied it."

"Why do you think I didn't just look at my lab frog and draw it?"

"It's too good."

"What does that mean, 'too good'? How can it be 'too good'?"

"It looks too much like a frog."

"Well, isn't it supposed to look like a frog? How can it look 'too much like a frog'?"

He had no answer — but still refused to accept my argument that when any number of people draw something that's supposed to look like a frog, all their drawings — in spite of all their variety and their range of artistic skill — are bound to look more or less like a frog. Not one is likely to look anything like a machine bolt or a calendar babe.

So I scrawled him a sorry approximation of a frog, a sketch more like what he thought a mush-mouth hick could do, and it satisfied him.

Several weeks later, he saw my sketch for a jacket patch — the head of a Dall ram encircled by the words *University of Alaska Wildlife Club*.

"Say, this is real good."

"Thanks."

"Who drew it?"

"I did."

"Yeah? Well, it's real good."

"I draw frogs, too."

His eyes stabbed me with a sharp look, and he hurried away.

Several who have seen the makings of this book have voiced their disappointment that I haven't toiled long and late at a drawing board with a T-square, triangles, drafting tools, and ink that crawls under every line guide. "Oh, you drew 'em *on a computer*. Huh!"

The computer of course has made all these drawings easier — but not nearly so easy as some fellows obviously think. Drawing on a computer is no easier than writing on a computer. No computer can produce anything from a writer's instruction to "write me a hundred-thousand-word psychological novel about a wimpy monk stranded on an uninhabited island with a lesbian whose knee is bigger than her head."

Even if a computer could turn out a novel all by itself, nothing it wrote would be likely to win a Pulitzer Prize. It would more likely produce the fiction equivalent of a Pullet's Surprise (if you can imagine a pullet laying a prickly pear). A writer or illustrator who creates with a computer still has to use all the skill, judgment, creative imagination, craftsmanship, effort, and patience he would use if he were working with a pen. The far more complex computer in fact requires more of all these, not less.

The great advantage of the computer (beyond its speed and precision) is the increased ease of making changes. One of the simplest text illustrations in this book, for example, evolved through at least twenty-five to thirty versions. The computer makes it easier to go from the thought *Hmm, this might look better if* to another temporary version that then suggests still another

version, and so on with another and another, until the thing finally looks right.

An equal number of interim try-and-see versions would take months or years with pen and ink but may take no more than a day or two with the computer. When I draw with the computer, I still have to figure out which line goes from where to where, then tell the computer how to give me what I've just figured out. Sometimes, drawing the line with a compass or a straightedge and pen would be simpler and faster. At all times, hand-drawing is less precise.

If the good Lord's willin' and the crick don't rise, Volume Two of *Custom Cartridges* (*loading and testing* ...) will follow this one as soon as I can get it done. Volume Two will include the dimensioned cartridge drawings I'll make from data I'll get after I've done Volume One, plus text chapters, for example, on advanced and experimental handloading, testing handloads, and calculating cartridge performance on a computer.

But Volume Two also won't be or include load data, historical notes, commentary, evaluations, specifications for tooling, notes on the rifles and handguns that use (or used) these cartridges, or a set of standards for industry reference. It may include chamber and reamer dimensions, since I have a passel of chamber and reamer drawings for cartridges I haven't been able to document with reliable *case* dimensions.

There seems to be no clear rule of thumb — not even a good rule of elbow — for determining the clearances between maximum cartridges and their minimum chambers, so I haven't been able to figure out any dependable way to make accurate cartridge drawings from the dimensions on reamer or chamber drawings.

That's enough about what's coming after who knows how many more calendar pages. Let's get on with what's here now, beginning with the next page.

Chapter 1

It ain't a "bullet!"

SOME PEOPLE who'd never think of saying or writing *ain't* call cartridges "bullets." A few years ago, a big-budget, prime-time television commercial included an ultra-closeup of what was supposed to be a big revolver bullet on its way from muzzle to target. That slick piece of animation showed an entire, unfired cartridge — case and all, presumably including primer and powder — zipping through the air, propelled only by the ignorance typical of the real dum-dums who most vocally damn guns.

Another example of this media ignorance appeared in a television news report on the attempted assassination of President Reagan. The animation that showed the path of the bullet through his body showed not just a bullet but a *complete, unfired cartridge*.

Not one of these people, I'm sure, would call a pickup truck a "sedan," a "semi," or a "convertible," and I know what they'd think of me if I called a car or truck a "tire" or "windshield." No one who manufactures ammunition, its components, or the equipment for loading it misuses *bullet* to mean *cartridge*.

I did for a while. When I was a child, I spake as a child, I understood as a child, I thought as a child. The loops on the cardboard-and-oilcloth holster for my cap gun held enameled wooden imitation cartridges that we kids called "bullets." But I put away a few childish things before I became a man. About the time I finally escaped those detested hand-me-down corduroy knickers, I learned some of the differences between a cartridge, a case, and a bullet. Both your safety and your satisfaction demand your respect for precise thought and terminology in every aspect of designing, forming, and loading custom cartridges, especially if you plan to shoot them.

When you buy and shoot standard factory ammunition in standard factory firearms, you can think of your cartridges as whatever you like to call them — "bullets," "capsules," "pills," or even "weird pencils" (you can write with the lead-tipped ones, after a fashion). They will still work the way they're supposed to work, and you haven't risked a thing.

You're not responsible for how well they have been designed and loaded, nor for how well they perform. Firearms and ammunition companies bear all that responsibility, and you can depend on them to honor their responsibility with admirable care and precision.

But if you want to learn anything about custom cartridges, to form and load them, to design a new one, or just to study or collect cartridges, you severely and dangerously handicap yourself if you don't first cultivate and use precise, accurate terminology in your thoughts and words.

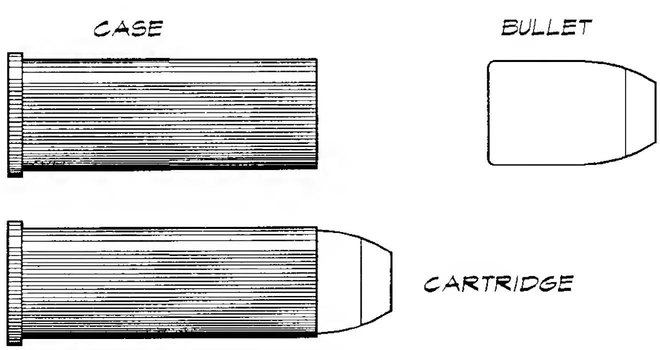
It does matter what you call things. When I

was a boy, a man I knew acquired a fine old brass lamp, a relic from an English sailing ship. It was an impressive and wonderful example of design and workmanship. Even the wick was in good condition. He polished the lamp and planned to use it prominently displayed in his home. Engraved in the side of the lamp's fuel reservoir were a horizontal line and words that said to fill it to that line with paraffin. So he filled it to that line with paraffin, and none of us could figure out why the lamp didn't work.

When I learned, years later, that *paraffin* was the Englishman's word for kerosene, I immediately thought of that old sea lamp and of course knew why it hadn't worked with paraffin from this side of the Atlantic.

"In a search of the suspect's apartment, police found bullets but no guns," a radio news report has just said. Bullets? Or cartridges? (And a TV reporter referred to a victim's "bullet-riddled car," which the killer had shot into with a load of double-aught *buckshot*. These professional purveyors of supposedly carefully chosen words really handle the stuff of their trade with admirable skill, don't they?)

The distinction between *bullet* and *cartridge* isn't trivial and could be crucial. In a police report, court testimony, or a search for information, the distinction is significant. The potential of a cartridge is far beyond what a mere bullet can do. All by itself, a bullet is inert and harmless, in every imaginable circumstance. A bullet that isn't part of a cartridge may be dangerous only if someone swallows it. Likewise, a case without primer, powder, or bullet is just a lifeless brass artifact with no danger, spark, or threat. Neither a case nor a bullet, all by itself, is more dangerous than a silver dollar.



A case (NOT a casing!), a bullet, and a cartridge — not one of these is "the same thing as" any other. Don't refer to them in the wrong terms if understanding and clarity depend on the accurate use of the right words, if you want to think or speak clearly and intelligently about them. Many educated people misuse the name of one to refer to another —but the people who make ammunition and these components don't confuse or misuse these words.

If a witness testifies about something he calls "bullets" and then under cross-examination has to correct his terminology to *cartridges* or *buckshot*, he has pretty thoroughly ruined his credibility. If he doesn't know the right words for what he's talking about, this basic ignorance casts serious doubt on everything else he says about it. If you ask a store clerk for "bullets" for your rifle or handgun, when you want cartridges, the clerk is not the one to blame when you find that the bullets he sold you just fall into the chamber and have no pep or pop when you pull the trigger.

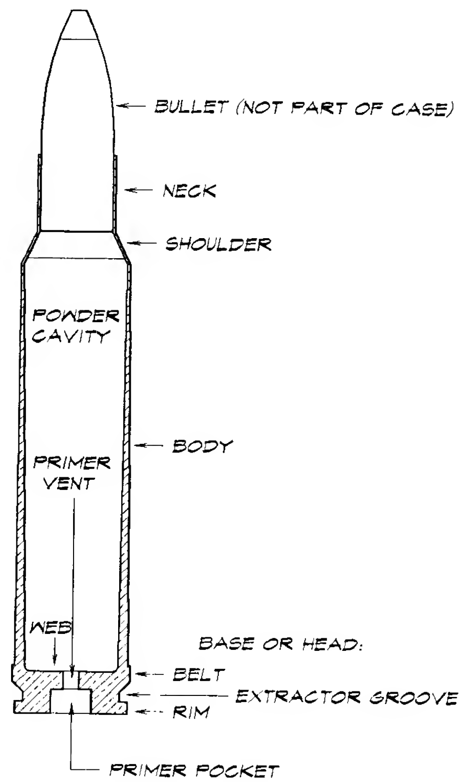
The most common source of the confusion about any matter is an incomplete or inaccurate grasp of its principal terms. Cultivate a keen appreciation of accuracy and precision in thought and reference — it's especially crucial to accuracy and precision in designing, forming, and loading custom cartridges. Any degree of sloppiness is a risk when you take on all the responsibility you'd otherwise leave to the companies that make and sell ammunition.

The brass device that holds the primer and powder, seals the breech, and grips the bullet isn't a "casing," either — it's a *case*. A casing is a tire body or the length of intestine a butcher or meatpacker stuffs with meats and fillers to make sausage. Call a cartridge case a "case," "brass" — or even a "hull" if you like to use flippant lingo —but never call it a "casing" until you've transformed it into a tire or a sausage.

Just as the case is part of the cartridge, it also has its own crucially distinct regions and features, and each of these has its crucially distinct functions. No one can fully understand cartridges without being easily conversant with their terminology or nomenclature. Certainly, anyone with a flicker of interest in custom cartridges especially needs to get all these things

straight in his mind and keep them straight.

Some cartridges have no belt, and some have no shoulder, but all modern centerfire cartridges have a rim, a primer pocket and vent, a body that encloses the powder cavity, and a base or head that includes the web that separates the primer pocket from the powder cavity.



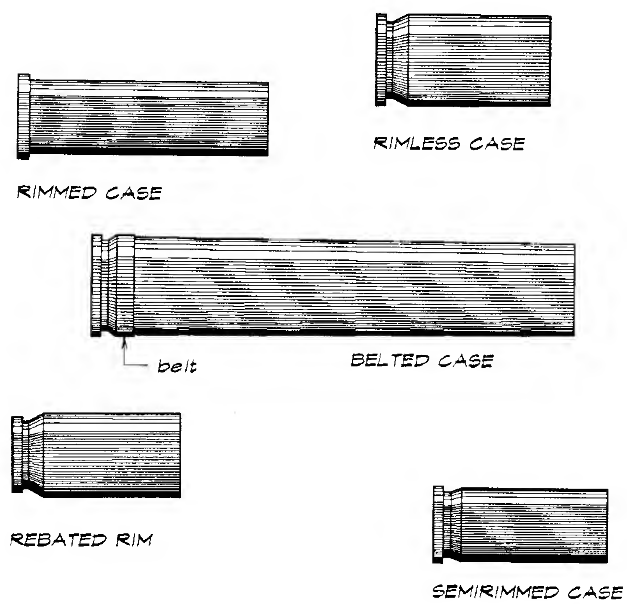
CARTRIDGE CASE AND BULLET

The brass cartridge case is one of the most productive basic developments in the evolution of firearms and ammunition. Even those who flaunt their professed independence of the cartridge case use alternate versions of it to improve their loads and loading. A multitude of enthusiasts prefer black-powder guns that load from the front. These guns depend on separate percussion caps or the even more primitive flint to produce the sparks that ignite their powder. This community of shooters spurn cartridge guns, but they often put up their loads in capsules, vials, tubes, or other cartridge substitutes for fast, easy reloading, for safe and consistent loads, and to keep their powder clean and dry. They spurn cartridges but love substitutes that help them get along without cartridges.

The case is the center of attention for anyone who designs or forms a custom cartridge. Its multiple roles and complex functions demand that it have certain qualities or properties, and these in turn have determined the necessary steps used in making it. When we modify a standard case to adapt it for use as a custom cartridge, we extend the manufacturing process. The step or steps that we add to the basic process may undo or overdo an earlier step.

For a good understanding of what we can do, must do, and can't do to the cases we use for custom cartridges, we must have at least a basic understanding of their vital characteristics and how the steps in their manufacture give them these necessary properties.

If we know how our cases have to be made, for example, we're less susceptible to attractive shortcuts that seem to offer alternative ways to make or modify cases we can't buy over any gunshop counter. A typical shortcut satisfies one or two requirements but defies other requirements — usually dangerously.



All types of cases have rims — even the "rimless" cases — although their type labels may suggest they don't. The rim on a semirimmed case is just slightly larger than the case body just ahead of the rim. The rim on a "rimless" case is about the same diameter as the case body at the base. A few cases have rebated rims — just a bit smaller than their bases. Every type of case needs a rim for extraction. Only the types called "rimmed" and "semirimmed" headspace on their rims.

The brass cartridge case functions as a good deal more than just a handy transport container that protects the primer and powder from accidental ignition, keeps the powder dry, and holds the components of the load conveniently and correctly assembled for safe, easy handling.

In any gun that loads from the front of its barrel or cylinder, the spark that lights off the powder has to get in through a hole in the rear or the side of the breech. That hole is the weak point of the otherwise solid breech. If there's no way to seal that hole, very hot gas comes squirting out under very high pressure when the gun fires.

Sealing the breech tight enough to contain high gas pressure is a key problem in basic firearm design — even with the much lower breech pressures of muzzle-loading and cap-and-ball guns. These old gun designs have no good way to let the igniting spark get in easily and not let the high-pressure powder gas get out. Also, the breech has to be easy to open and easy to get the spent case out of, to allow for fast reloading and successive shots.

The brass cartridge case is the gasket that seals the breech after the burning of the powder begins to develop significant pressure. It keeps the breech sealed against gas leaks until the bullet exits the muzzle, then it relaxes its seal and lets the breech be opened easily. Before the brass cartridge case became part of the breech, no other material could provide this combination of functions. Materials that sealed the breech would not let it be opened easily. Materials that let it be opened easily couldn't seal it tight enough. No gasket material suitable for other kinds of sealing could withstand the incredibly high pressures of a gun breech.

Even the ordinary pressure cooker has to have a strong, solid lockup and a tightly clamped thick gasket to operate safely at the very mild operating pressure of only fifteen or so pounds per square inch (psi) above the pressure of the air in the kitchen. The pressure cooker is neither easy to open nor easy to close, and it can't withstand anything like the normal operating pressure of a gun breech.

The home water faucet is another example of how easily a substance under even moderate pressure can find its way past a worn or flawed gasket. The new insert for attaching a special filter to my kitchen faucet spurts a fine squirt off to the side, no matter how tight I screw it on. And everybody knows how easily a steady *drip, drip, drip* can get past a faucet washer that looks as good as a new one, even after you've turned the faucet shut as tight as you can twist it.

A rifle breech has to withstand normal chamber pressures as high as 55,000 pounds per square inch and higher. Some especially strong bolt-action rifles have held together at pressures I'm sure were more than twice that high.

The unit of measure (pounds per square inch) originally used to express chamber pressures turned out to be misleading. No one could be sure the units of measure they called pounds per square inch were actually pounds per square inch. A couple of new units then came into use with the copper and lead crusher discs used in older pressure-measuring systems — called copper units of pressure (cup) and lead units of pressure (lup). Authorities who used these terms didn't really know how their pressure measurements related to the traditional units of pounds and square inches, so they simply called them copper and lead units of pressure.

More recently, I'm told, electronic strain gauges can accurately measure the minute expansion of a barrel under peak chamber pressures from burning powder and indicate the internal pressures that cause that expansion.

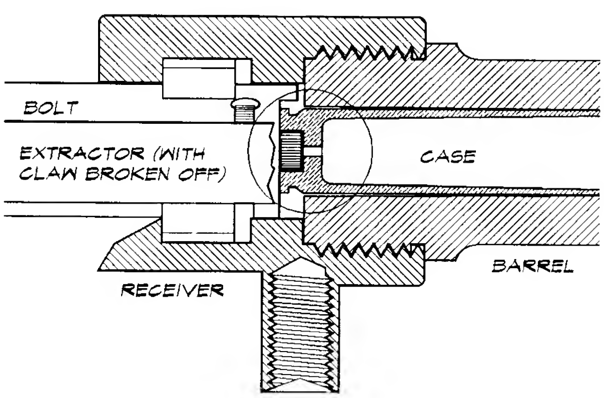
Our concern with safe and dangerous chamber pressures doesn't require us to express them relative to the weights of elephants or the sizes of postage stamps. By long and often bitter experience, firearms experimenters have fairly well determined how to tell when safe loads are about to become dangerous. Whatever units we use, if we use any units at all, we compare pressure signs to keep our loads safe. Too much pressure is too much, and enough less is as safe as a baby's crib.

The brass in a good cartridge case is an alloy of very high quality — seventy percent copper and thirty percent zinc — called simply "seventy-thirty brass." Since it's primarily a quickly and easily replaceable breech gasket or seal, it's a vital part of the gun itself. The gun can't operate without it.

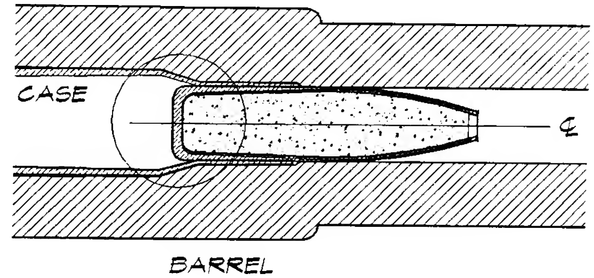
The secondary role of the case is a handy container for the expendable components of the load. It protects these other components while it's apart from the gun, and it aligns them properly with the firing pin and bore when it's in the breech before and during firing. In terms of its functions, then, the cartridge case is three things in one — a gasket, a jig, and a capsule, in that order of importance.

As a capsule, it's just another part of the load. If this were its only role, it wouldn't have to be just like the containers that hold the other loads for the same gun. Its shape doesn't matter to how well it functions as a protective container for the primer and the powder. To the case as a simple container, the bullet is just a plug or stopper. A plain rubber plug or a tight plastic cap might be a better stopper. As long as the case and bullet fit together and come apart fairly easily at the right time, don't let the primer or powder fall out, and keep them both snug and dry, neither the case nor the bullet needs any special care to make them form a good capsule.

But of course the case isn't just a capsule. In its far more crucial roles as a breech gasket or seal and an internal breech jig, the case is as much a part of the gun as any of the most precisely fitted steel parts in that gun. The design and manufacture of the case ensure that each section, dimension, and property of the case



In its primary function, the brass case is the gasket that seals the breech and keeps the high-pressure powder gas from spurting out through the action when the cartridge fires.



The case also functions as a jig to hold the bullet aligned with the longitudinal axis of the bore. At the other end, it also holds the primer aligned with the firing pin or striker, in position for firing.

adapts it to function well in each of its roles in the operation of the gun, as if it were instead a single steel part in the internal works of the gun.

Its material, its dimensions, even its several hardnesses are as important and as carefully ensured in manufacture as the same properties of the receiver, bolt or block, barrel, firing pin or striker, trigger, or sear.

To function well as a gasket, the cartridge case has to wait in exactly the right place (and it has to hold the primer in exactly the right place) for the firing pin to strike the primer. It has to slip easily into that position as it enters the chamber. It can't require of the shooter the kind of time, attention, special tools, or dexterity a plumber needs to seat a washer in a bathroom faucet or an automobile mechanic needs to put a new neoprene seal in an automatic transmission.

The shapes of most bullets help cartridges slip into the chambers easily. But more important by far are the outside diameters of the case and the dimensions of its headspace system. Its outside diameters must be small enough to let it slip easily into firing position, yet large enough to leave almost no space between the case and the walls of the chamber. It has to slip in easily, almost seal the breech even before it's fired, then come out with only moderate persuasion to let the next cartridge enter the chamber.

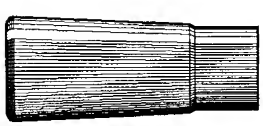
The head of the case and the face of the primer must rest near or against the face of the breech. The mating diameters of case and breech align the primer near or on the axis of the firing pin. The critical dimensions of the case and

chamber headspace surfaces place and hold the primer against the face of the breech and make sure the case firmly resists the blow of the firing pin so it can ignite the primer without hanging fire or misfiring.

The dimensions and tolerances of the case determine how reliably it functions as a gasket and jig. If it fits the chamber fairly closely but is loose enough to be easily inserted into the chamber, it's a good gasket and a good jig. Each of its dimensions can be slightly off the specified dimensions. The case tolerates these variations without a hitch or a hangup (which is why they're called "tolerances"), but they have to be only a few thousandths or ten-thousandths of an inch larger or smaller than the specified dimensions.

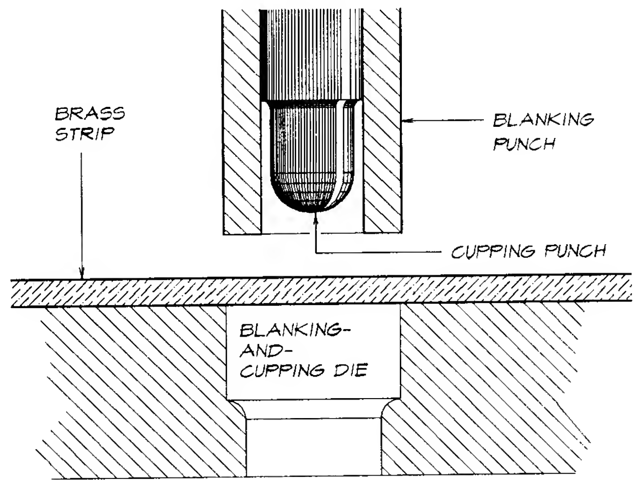
Besides being a semiexpendable container for powder, the case is the removable, replaceable, reusable part of the gun that contains and aligns the load. After an individual case does its job, it has to be easy to discard for the moment if not for good, to let the one behind it come into place without a hitch, hindrance, or hang-up.

This ancient autoloader case depended on the backward thrust of the expanding powder gas to blow the spent case to the rear — and clear of the breech — when the firing of a normal round blew the breech of the pistol open. But duds, squibs, and other problems showed that even this truly rimless case needed both a rim and an extractor groove for easy, dependable extraction. A case needs a rim more than a pencil needs an eraser.

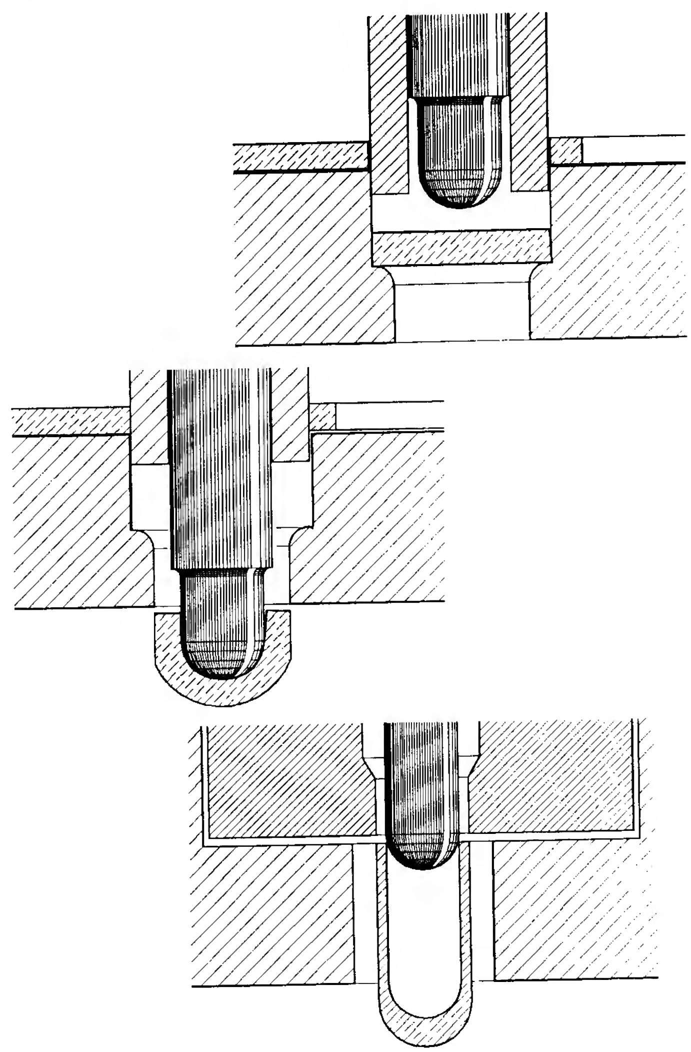


The several functions of any cartridge case explain why so much care and handling go into designing, making, modifying, and loading it. Practicality requires that cases be plentiful as well as precisely made, economical as well as consistent in their dimensions. No other part of the gun has to be so readily replaceable, even expendable, yet precise. We need a good number of them to supply our shooting sessions from loading session to loading session and to allow for the normal loss of ejected or damaged cases.

I like to keep a minimum of a hundred matched cases on hand for any rifle cartridge I



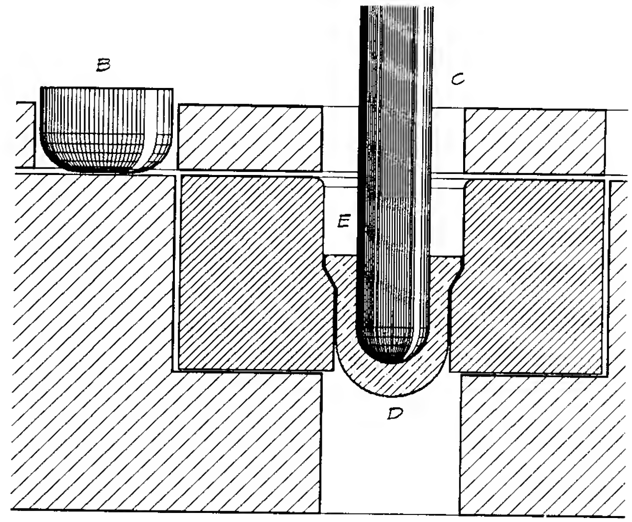
From a wide strip of thick 70-30 brass, sets of blanking and cupping punches and dies (above) stamp out flat "coins" (below) and form them into the basic cups (2nd from bottom) that other case-forming machines draw out longer and longer (bottom) and finally form into cartridge cases.



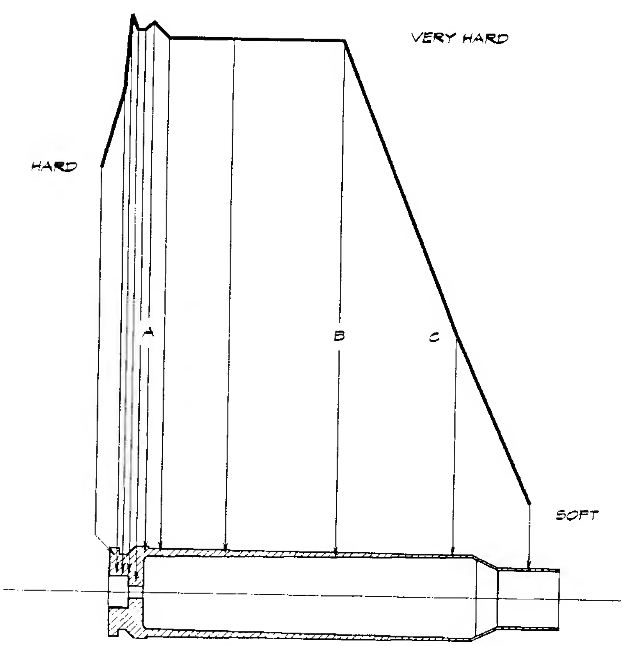
load, and five hundred or more for any handgun cartridge. Either one hundred or five hundred cases would be expensively impractical — impossible to most shooters — if cases cost as much to make as any typical steel gun part.

These are conflicting requirements — that cases have to be precise and uniform, yet affordable or even economical in large quantities — and give manufacturers a huge problem. They have to machine a costly material to consistently precise dimensions by the millions and billions, then advertise, distribute, and sell them at prices that you and I can afford to pay for however many of each we need.

All this makes the case the most expensive component of the cartridge. The methods ammunition makers use to make cases vary a little from one manufacturer to another, but the generally similar processes comprise essentially the same steps. The traditional and usual process starts with a long, wide strip of thick, annealed (softened) brass. One or two makers start with round bars, then do essentially the same things to the brass bars that others do to brass strips.



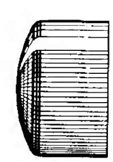
In the first draw die, a rounded punch (E) forces each cup (B) through a die (darker hatch) that reduces its diameter, thins its walls, and draws it out longer (D). In this draw and the later draws, the base of the cup does not get drawn thinner but remains about the same thickness.



There's more to the relative hardnesses in a properly work-hardened and annealed case than just "hard in the head, soft in the mouth." Drawings in the Lapua manual show this complex of hardnesses in a typical case.

In the first step with the strip, a machine punches several discs out of the strip at one time. At the same time, this punching operation (called blanking and cupping) forces the discs (called coins) into dies that form them into wide, shallow, thick-walled, round-bottom cups. Makers who start with rods instead of strips cut off thin, solid cylinders, then draw these cylinders into the same kind of cups.

Each mechanical working (called cold working) of the brass makes it harder and stronger but also more brittle. Making the brass into cartridge cases comprises a series of shape modifications that harden the brass, then soften it, then harden it again, then soften it again. The process produces finished cases that are (and have to be) harder and stronger at one end, softer and more workable at the other. Modifying or converting a factory-made or "parent" case to form



A cup ready for its first draw

a custom case always comprises one and frequently more of the steps that formed the factory case, for exactly the same reasons these steps were necessary in making the original case from either a sheet or a rod of brass. To some degree or another, anyone who re-forms a case into a custom case is partially remanufacturing it.

The strip or rod was originally annealed (softened) slightly to make it workable, but the discs punched out of the strip (or cut off the rod) and formed into cups get harder under this cold working. They go next into the annealing furnace to be softened enough to be workable.

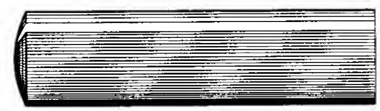
This annealing is a picky step. If the cups come out of it too hard for the next operation, they can break punches in the next machine, or the punches may ruin them. If they come out of the first annealing too soft, the next working doesn't harden them enough to come out of the several later annealings with the proper hardness after each step.

A pickling bath in a solution of sulfuric acid removes the dirt and annealing scale, then a water bath rinses off the acid.

Annealing is the first manufacturing step that we who design and form custom cartridges often have to duplicate, to avoid ruining our valuable cases. The chapter on forming custom cases goes further into this necessary but demanding operation.

Next, punch-and-die machines draw these cups out deeper or longer. The bottom of the cup stays thick. The walls get thinner as each draw makes them longer. The first draw reduces the diameters of the cups and hardens them, so they go through another annealing, acid bath, and water rinse, then another draw.

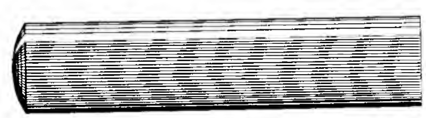
The dies and punches in the second draw are smaller in diameter, but the operation is essentially the same as the first draw — the cups get smaller in diameter, longer, with thinner and thinner side walls.



To keep the thick heads from thinning, another operation flattens and thickens the round bottom of the cup. An anvil punch inside the cup supports it while a hammer comes down hard on the end. This flattens the outside of the head and leaves the inside flat in the center with a surrounding fillet. This bumping operation partially forms the head of the case to give it enough material for its final machining later. Bumping must follow one of the early draws, since later draws could leave the head of the case too thin to be machined to its final dimensions.

Another annealing, pickling, and rinse get the cups ready for their third draw, which then reduces their diameters and thins their walls a bit more. Then, washed and dried again, they're ready for their first trimming.

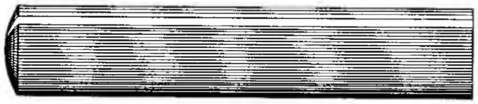
Three draws and a bumping turn the cup into a blind tube. Its walls, thick where they fair into the head, taper to a very thin edge at the ragged, uneven mouth. This cylindrical tube is visibly longer than the finished length of the case. At its open end, the thickness of its sides has to be within dimension tolerances and very nearly the same all around.



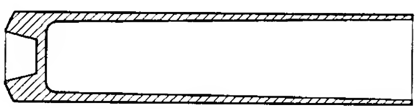
The draws have kept the wall thicknesses pretty even along most of the length of the elongated cup, but its walls have become uneven and ragged closer to the mouth, with irregular tags called "pig ears." Farther down the production line, the cup has to have fairly clean lines to go smoothly through the machinery, so the first trimming cuts the pig ears and some of the excess length off the open end of the cup to make the later operations go smoothly.

After the fourth draw, the cups are annealed, pickled, rinsed, and washed again, then

trimmed again to take off the irregularities introduced in the fourth draw.

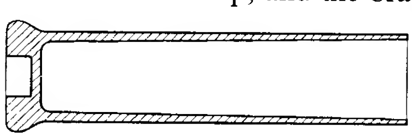


Now the cups look almost like cartridge cases. They're about the same hardness (still too soft) from head to mouth. The heads have to be significantly harder, so the next step is a special, localized cold-working to harden them. A rigidly fixed internal punch or anvil supports the cup against the impact of a pocketing ram. A small punch formed onto the face of the pocketing ram makes a deep, large dimple in the center of the base of the cup. This pocketing operation forms only an approximation of the finished primer pocket — later steps form the pocket to its final primer-seating dimensions.



After the pocketing, an operation called "heading" gives the cups essentially the same treatment again but adds a couple of special touches as it further shapes the primer pocket and work-hardens the case head.

The pocket-forming punch, a bit larger than the one used in the pocketing operation, enlarges the primer pocket a little. The heading ram really smacks the end of the cup, and the brass flows



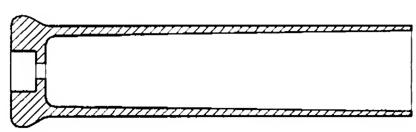
under the impact — with two results that make the cup look almost ready to slip into a shell holder. The impact of the header makes the brass flare out in about the same way a hammer blow flares the top of a cold chisel or a tent peg, but the edge of the flare is smoother.

The flare or flange becomes the raw material for the rim of a rimmed or semirimmed case; it'll all be trimmed away if the cup is to become a rimless case. On the face of the case head, the impact imprints the head stamp — designations for the maker and the cartridge on commercial cases, maker letters or codes and year numbers on military cases.

Ahead of the base, the case must be softer — much softer at the mouth — but the head must be hard. The face of the head will be one of the hardest parts of the case. The rim, for headspacing or extraction, has to be hard and tough enough to withstand the pull of a strong extractor even when high peak chamber pressures and the rough mating surfaces of case and chamber lock the case tight in the chamber. The impact of the heading ram pounds the head brass hard enough to make it a little denser and harder than it was — harder than the rest of the case.

This carefully, closely controlled hardening of the head in the manufacture of the cartridge case is another step that we who design or modify cases have to keep in mind. Any further modification step that hardens this area of the case can make it too hard, even brittle, and all repeated firings are just that many more heading operations as far as the case is concerned. The head of the case gets harder in repeated use, so any extra hardening you or I might give it by machining it to new dimensions, for example, may leave it with fewer firings in its normal life expectancy.

Next, a venting punch pokes a primer vent (also called a "flash hole") through the web at the bottom of the primer pocket. The venting punch is the smallest and therefore the most delicate punch used so far, so the hardness and thickness of the web brass are crucial. This tiny punch wears, bends, and eventually breaks under the harsh and variable conditions of its job. From the beginning to the end of its useful life, it makes correspondingly variable primer vents.



The diameter of this punch varies a little in use. More noticeable by far are its effects on the web. I've never seen a brittle or crumbly web, but I imagine the inspectors at the factory occasionally have to reject cases because hard brass has broken away under the venting punch, leaving a

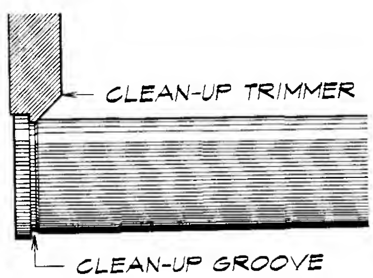
ragged and oversize primer vent. I have seen a wide variety of burrs on the forward side of the web, and some webs that had been bulged inward. What the inspectors pass is pretty uniform.

I've had only one batch of consistently bad primer vents, and that was an enormous supply of really bad ones — nearly two thousand military cases (5.56mm NATO) with primer vents so far off-center that one leg of the primer anvil could cover enough of the primer vent to reduce the net opening of the vent by half. I ruined a decapping stem finding that out.

Next, a pocket sizer swages the primer pocket out to its final dimensions. This operation works the head only a little, with no discernible change in head dimensions and only a bit more work hardening of the brass around the primer pocket. Head turning, the final shaping of this end of the case, comes next. Head dimensions and tolerances are critical, so head turning has to be precise.

It must also leave smooth surfaces that need no further finishing. In only one pass, a specially shaped form cutter shaves the rim to the proper diameter and thickness, cuts the extractor groove around rimless cases to the right width and depth, and neatly bevels both the rim and the groove.

This form cutter sometimes leaves what looks like a tiny extractor groove just ahead of the rims of rimmed cases.



This narrow, shallow groove has nothing to do with case extraction. When the heading ram formed the oversize flange or bulge that would later become the rim, the forward surface of that flange included a rounded fillet where the body of the case flared out to form the flange. In the turning of the head, the form cutter turns this fillet away to leave a clean right angle between the front surface of the rim and the side of the body. To make sure no fillet remains to interfere with headspacing, some outfits make their form tools cut this little clean-up groove.

Clean-up means the cutter "cleans up" or removes the unwanted and possibly intrusive fillet of brass. This term, misunderstood, has given this groove an unfortunate nickname "dirt-catcher," and the notion that the groove somehow collects dirt and debris that might otherwise interfere with easy chambering and extraction.

This folklore, born of misunderstanding, pops like a soap bubble when you realize that this groove can not possibly do what this myth suggests. It doesn't enter the chamber ahead of the rest of the case, so it can't clear the way for the rest of the case. The mouth of the case clears away any minute grit or gravel inside the chamber before this little clean-up groove (not "dirt-catcher" groove) gets anywhere close to the chamber opening.

Back to cases being made.

Machining leaves tiny brass chips in and on the case. Another bath cleans them off. Then another annealing softens the forward portion of the case to get it ready to be trimmed to its final length. A sizer ball or plug makes the mouth end slightly smaller than bullet diameter, then the slightly long case gets still another bath. Finally, the spinning case encounters the cutter that trims it to its final length. The trimming cutter leaves fine burrs or "feathers" at the mouth, which we handloaders have to remove later (easily) with a deburring tool.

Finally, an acid pickling bath, a water rinse, and a polishing bath clean the case again and leave it looking essentially finished. But all the machine working of the case has left its mouth too hard. The brass at the neck isn't resilient enough, so the forward portion of the case gets another trip back into the flames. Annealing heat discolors the surface of the brass.

American cartridge manufacturers remove this harmless discoloration from most of their commercially available cases but leave it on cases for the .458 Winchester Magnum, however, so they will look right to hunters who have become accustomed to seeing it on British cases for big-game rifles and may even expect it. Neither the absence nor the presence of this discoloration has any special significance.

Chapter 2

Don't eat your pig too soon.

A PUZZLED visitor asked a farmer why one of his pigs had a wooden leg.

"Let me tell you about that pig!" the farmer exclaimed. "When the house caught fire, that pig climbed out of the sty, woke up me and Sadie, led us out through the smoke, then went back in the house and brought out our important papers wrapped in a wet towel!"

"And he somehow got injured in the fire?"

"Oh, no," the farmer said. "Another thing about that pig. When the tractor rolled over and pinned me down in the middle of the night, that pig heard me hollering. He ran out to the field where I was, rooted dirt away from around my leg, and pulled me out from under the tractor."

"Oh, and he got hurt doing that."

"No, no, no. Another time, that pig—"

"I see, I see!" the visitor broke in. "That is *some pig!* But tell me, please, *why does he have a wooden leg?*"

"Oh, my!" the farmer exclaimed. "You just don't eat a pig like that all at once!"

I once told this story to a man who was using up his company the same way that farmer and his wife were using up their pig. (The man didn't get it. I had to explain the point of the story to him, so you may have to explain it to one of your buddies, too.) That farmer would've been smarter not to eat any part of his priceless animal.

And how does that point apply here? If you plan to load a cartridge yourself — especially if you're going to load the cases more than once — you owe it to yourself to start with good brass and treat it well. The *Lapua Reloading Manual*, first edition, asks rhetorically, "Why is the case so expensive?" then tells why:

"The raw material — brass — is not worth much, but the manufacturing is a very labour intensive process. When Lapua manufactures a case from a circular brass washer, also known as a 'coin,' it takes no less than 24 steps before a shiny new .30-06 case is born. It is deep drawn four times, lubricated, tumbled, washed, dried, cut, turned, drilled, punched, stamped, annealed *etc*, many times over. Although inspected by machines after each step, the final inspection is still done by human hands and eyes. It is small wonder that the cartridge case is an expensive precision component.

"Luckily, the case can be reused 20, 30, maybe even 40 times, when it is properly treated and not used for 'hot' loads. It makes sense to shoot 'normal' loadings to conserve and recycle this most expensive component."

In other words, *be nice to that pig.*

The first step in good case care is to develop a good basic system of loading it. The kind of fellow I think of as a typical reader of this book already knows the basics of handloading and has spent many enjoyable and tedious hours at it.

But I hope a lot of other folks will find this book useful, and I dare not assume every reader is typical. I owe the equally welcome newcomer an introduction to our craft, to make the detailed information in this book as digestible, interesting, and useful to him as it is to old bench hands. And for what it's worth, I've found that a surprising number of experienced handloaders still haven't picked up all the tricks you can pick up from this basic chapter. Whether you're green or ripe, you need to know a few things about basic handloading techniques before you consider designing or forming custom cartridges. I assume you know them — but in case you don't remember them all ...

Most of us take up handloading first to save money and then find how easy it is to make our loads accurate, too — without risk, if we're careful. Sloppy handloads take almost as much effort as good ones. Making our ammo economical, accurate, and safe takes only a little more time and care.

The main difference is that careful handloaders use orderly, consistent procedures to cut down the number of opportunities for making mistakes — and dependable, uniform components to make sure his loads aren't erratic.

Handloading also offers other possibilities. Custom cartridges are available only through custom loading, which most often means you have to load your own. Through careful handloading, we can correct some firearms problems and limitations and exploit certain potentials — neither of which is possible with factory loads.

For example, by simply changing how far down you screw the sizer die in the loading press, you can correct a problem of excessive headspace, if the cartridge you're loading headspaces on the shoulder.

(The handloader can fire-form the case to fit the chamber, then set the die to preserve the shape and crucial longitudinal dimension of the fire-formed case. In other words, don't reintroduce excess headspace by pushing the shoulder back to fit the *die's* headspace dimension each time you resize the case.)

"Good enough" never is, for a loading bench, components, equipment, or procedure. I always use the best equipment I can manage, even when I can't afford it, because I want good ammo, not cheap junk. But a good loading bench and its equipment are the stuff of other chapters or even other books. (Chapter 7 will tell you where to get construction plans for good, strong benches you can build — or have someone build for you. There's even a real hippopotamus of a ready-built bench for the fellow who must have nothing less than the best.)

For now, let's go over the simple procedures I use to make my loads as accurate, safe, efficient, and economical as I can. One nice thing about careful handloading is that I don't have to bother with most of these tricks once I've set up a systematic procedure, chosen the right components, and made sure everything is set up right.

I **start with good brass** *and take good care of it.* The urge to save money often leads us to skimp on the one thing that's most important to accurate, safe, economical loads — the brass cartridge *case*. The brass that I've picked up at the range or just here and there usually turns out not be as economical as it seemed at first. It doesn't cost anything at first, but it may not last for many loads, either. It can soon cost me more than fresh, new, store-bought brass.

If I start with one batch of cases and then switch to another batch, the performance of the load may change. It may even be unsafe in the new cases — or it may just be slower or less accurate. Anyway, a change of brass means I have to use up more primers, powder, and bullets to see how the load performs. I may have to develop my load all over, from scratch. "Free" brass can be very expensive in the costs of these extra components. Questionable brass will have to be replaced pretty soon, anyway, so I *start* with good brass and avoid the nuisance and extra expense of replacing old brass soon after I've developed a good load.

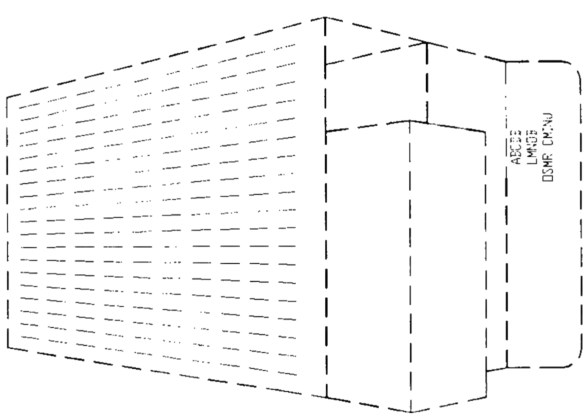
It's especially important to start with new brass when I have to work it over somehow to adapt it to a new working life as a different cartridge. The more I have to do to it (and the more it has to go through), the more important it is that it be fresh, new brass when I start annealing, expanding, necking up or down, shortening, fire-forming, *etc*. The best ways to get the first batch of brass are (a) to save the empties from a

single good supply of factory ammunition, and (b) to buy a good supply of fresh, new brass.

I like to start with at least a hundred cases, but the best number really depends on what I intend to use the gun and cartridge for — or how many rounds I want to shoot before I have to load another batch of ammo. I'll never shoot my .416 or any of my .450s as much on a single hunting trip as I customarily shoot my .22 Hornet, .223 Remington, or .22-.250 on even a short gopher or prairie-dog hunt — and I take the varmint rifles out a lot more often than I use the big ones.

Forty or fifty cases is probably enough for a safari rifle, but a *thousand* isn't too many for one of the varmint rifles. If I load ammo for a revolver, I don't need as many cases as I ought to have for an autoloader (which throws so many where I can't recover them). So I start with a good supply of new or once-fired brass, *all of the same make* and preferably from the same lot, *but never mixed.*

I've learned to be wary of unknown brass and somebody else's handloads. Cases don't spoil with the passing of a little time, so their age alone isn't anything to worry about unless they are really ancient — but there's no telling what they've been loaded with or how many times they've been fired.



Somewhere on every factory box of cartridges or cases, a rubber-stamped Martian love note (usually on the flap or edge of the box) identifies the "lot" of those cartridges or cases. Whenever you can, start with new or once-fired brass, all the same brand or make and preferably all of the same lot.

I inspect all my cases carefully, even if they're brand-new. Fresh brass is usually sound — but not always. I've had some with their primer vents so far off-center that they had to be decapped by hand, not in the press, to keep from breaking decapping pins and bending decapping spindles. It isn't unusual for the mouths of new brass to need trimming and chamfering. Fired brass can have other defects. I look them over for

- split mouths,
- enlarged primer pockets,
- wrinkled mouths,
- scratches that run up and down the neck or the entire case, indicating that the case has been handloaded, and
- a bright ring around the base just ahead of the extractor groove, indicating that the base of the case may soon separate from the body.

Most of all, I look out for splits or cracks anywhere on the case. I discard all cases that have any of these dangerous flaws, no matter how good they are otherwise.

Most sizer dies are set up to decap at the top of the sizing stroke. But despite the convenience, I don't like to combine resizing and decapping in the same operation. Cases are harder to clean properly when the primer is in place, and decapping drops grit from spent primers all over the immediate work area. So if I'm about to load some fired cases, I decap first, preferably in a separate press dedicated to decapping. Then I clean, polish, and wipe my brass before it gets near the main loading setup.

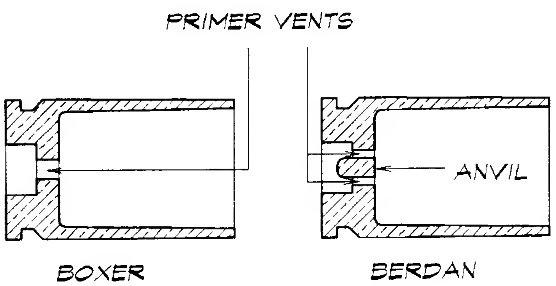
I often decap cases by hand, with a decapping punch, a steel base cut out for the primer to drop through, and a mallet. I made one of my decapping punches out of a steel rod — salvaged from a switch on an old television set — and a spare RCBS decapping pin. I drilled a hole into one end of the rod, dropped a tiny chip of solder into the hole, pushed the decapping pin in on top of the solder, and sweated the works together.

If the pin breaks or bends, I can replace it simply by melting the solder, pulling the stub or bent pin out, and sweating in another.

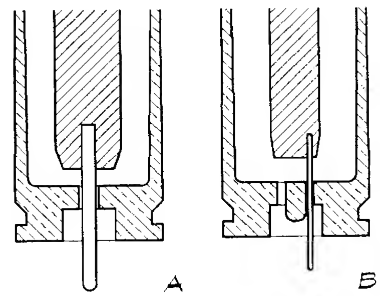
By the way — don't give up on Berdan-primed brass. If you have or can get good Berdan-primed brass for your cartridge, *load it.* A neat little decapper, an alternate version of the

simple home-made, hand-operated Boxer decapping punch I've just described, is just too easy to make and use, to throw away good brass just because its primer pocket has a built-in anvil and its web is vented for Berdan primers.

from RCBS, Berdan primers from Huntington Die Specialties, and you're all set — once you've made one of these decapping punches. It's easy to make and easy to use.



Look deep into the mouth of a case to see whether its primer is a Boxer or a Berdan. One centered primer vent means it's a Boxer-primed case. Berdan-primed cases have a number of off-center primer vents. The two types of primers are not interchangeable.

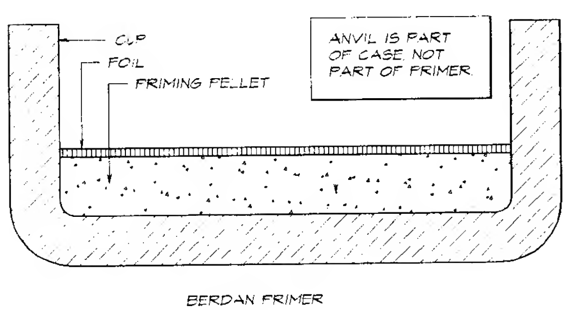


When I decap fired cases by hand, I use these home-made punches. My Boxer punch (A) is a regular decapping pin sweated into the tip of a steel rod, along the axis of the rod. My Berdan punch (B) is a piece of music wire sweated into the tip of another rod — parallel to its axis.

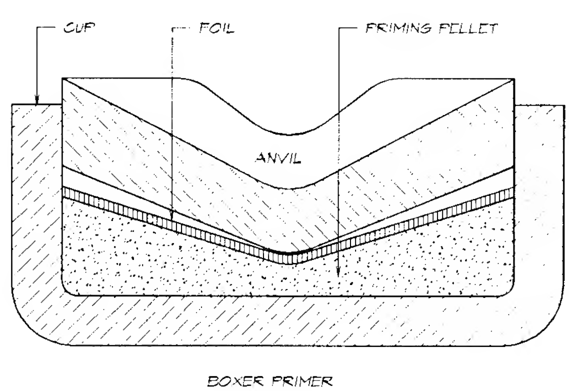
I don't remember what ballistic advantages the Berdan primer is supposed to offer, but whatever they are (real or imagined), Berdan primers are all you can use in Berdan-primed brass without extensive and only marginally satisfactory case modification.

Besides, it's not un-American to use non-American primers. A Briton invented the Boxer primer, and Berdan was an American, so which primer is more American than the other (as if it mattered)? So get a special Berdan primer seater

Get a length of steel rod an inch or two longer than the case and small enough in diameter to enter the case mouth easily. Drill into the end of this rod — *parallel to, but not on, its long axis* — a short hole for a piece of straight music wire that's (a) small enough in diameter to enter the Berdan primer vents easily and (b) just long enough to push the spent primer clear of the primer pocket. Slip the rod into the case, turn and wobble it around easily and slowly until the music wire drops into a primer vent (easier than



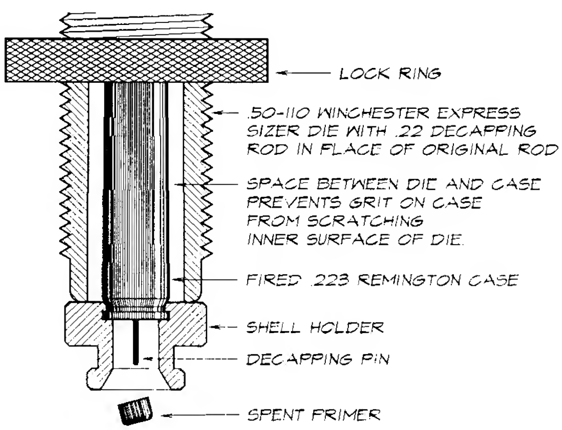
The Berdan primer (above), an American's invention used in the rest of the world's ammunition, has no anvil of its own. The Boxer primer (right), used in American ammunition but invented by a Briton, includes its own anvil.



it sounds), and tap the upper end of the rod with a light hammer or mallet.

When I decap cases separately in the decapping press, I use the sizer die for a huge cartridge (a long .50 cartridge) fitted with the decapping rod and pin for a .22 cartridge. The case doesn't touch the inside of this die, which is simply a jig to hold and align the decapping pin. I suggested this decapping die to RCBS as a new product several years ago, so they may offer something like it one day soon. After I've decapped all my cases, I use a short, pointed wire to pick the grit loose in the primer pocket, then I dump it out with a sharp base-down rap against something firm but not too hard.

I haven't had much luck with any of the neat little brushes made for cleaning primer pockets. They get all frazzled after a few pockets and don't do as well as my picking and dumping.



With this arrangement, I can decap (for example) several hundred .223 Remington cases in one sitting, without getting any grit from the cases in my sizer die. The sizer die for any cartridge significantly larger than those to be decapped — if it's threaded for the appropriate decapping punch — works just as well. I favor the .50-110 die because I don't need it for anything else and can leave it set up as a universal decapping die.

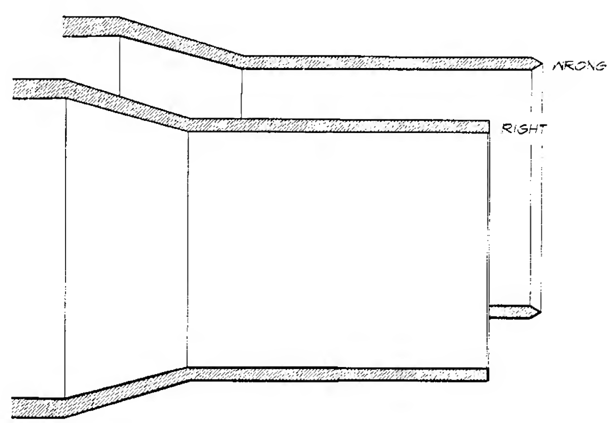
I prepare selected cases for loading by making them all the same length. Since I load a variety of nonstandard cartridges, I prefer a dial caliper to a case-length gauge. I measure each and every case in my supply of brass to find the shortest one. I trim a longer case in my case trimmer, taking off a little at a time, until it's the same length as my shortest case. I set the trimmer at this length and trim all the rest of my brass so that all are exactly the same length.

I don't have to trim before every loading, just whenever my cases stretch past the lengths shown in my handbook — or when they stretch unevenly. This is *not* just a nice but unnecessary touch — it's a vital preparation of my brass, especially if I crimp the mouths of my cases around the bullets. Uneven necks and crimps make chamber pressures erratic. The best result I can expect is lousy accuracy, the worst an unsafe hunting load.

One of the best habits I've developed, for consistent and safe loads, is to process all my brass at every step before I go on to the next step. This system takes less time, not more, and I'm less likely to make mistakes. No other system I've tried is as efficient or as nearly foolproof.

Next, I deburr the mouth of each case, inside and out, with a chamfering and deburring tool. I don't cut away enough brass to make the mouth sharp; I just knock the burrs and corners off. I try to make the chamfers more or less consistent, especially inside the case mouths.

I shake the cuttings out of each case after each trimming and deburring. If my cases are new or have been fired only once, they're not likely to need cleaning. But fired cases that have



The mouths of factory cases usually have burrs and sharp edges. Trimmed cases always do. A twist of the wrist with a simple deburring tool removes them. But don't overdo it. Just take the burrs off and slightly blunt the edges —don't make the mouth a single sharp edge.

been lying around for any length of time pick up all kinds of fine dust and grit — so they have to be cleaned off before I lubricate them and shove them into my valuable, precision-made sizing die. I've used several good commercial case cleaners for brass that's too dirty to wipe clean.

I never lubricate or size dirty brass. Grit on the case can get embedded in the wall of the sizing die, or raise a steel burr there, and the die then scratches the cases that I size in it. Deep scratches may weaken the case and make it crack or split when I fire a load in it.

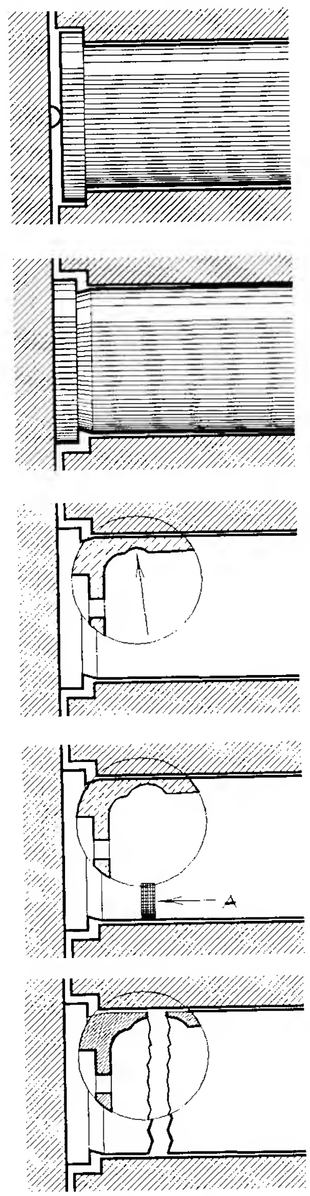
Lubricating the case is a crucial step — the right amount of the right lube at the right time. Some handloaders lube all their cases at once, then size and load them all. I **lubricate my brass** one at a time with a little lube on my fingers, as one step in the loading process.

My favorite case lube is Bob LeClear's Imperial Sizing Die Wax (it's in Brownell's catalog), by far the best of the several excellent lubes I've used. A little goes a long way — and it isn't messy or bothersome. With LeClear's wax, I don't have to wipe every case. One light dab of lube on one case transfers enough to the inside of the sizing die to lubricate the next several cases. Dave LeGate once decided to see how many 9mm Luger cases he could size with just the one tiny swipe of wax he applied to the first one. He chickened out after nine cases — worried that the tenth would surely stick in the die. A case without enough lube is almost certain to stick in the die, so tight that the shell holder pulls the rim off. Getting it unstuck is easy, with the right tool, but requires a little effort and ruins the case.

I still have a case I stuck and extracted in 1957 — and it has its own story to tell, so please excuse this short digression. Besides, it's time I reveal the origin of a rare but infamous device I "invented" as a prank and used several times.

Before I discovered a better lube, I used some picky, sticky stuff that was too easy to get too little of (or too much). I stuck a case in the sizer die, and the shell holder pulled the rim off. So I hurriedly invested in a special doodad for pulling stuck cases out of sizing dies. The kit comprised a pilot drill bit, a 1/4-20 tap, a 1/4-20 Allen-head cap screw, an Allen wrench, and a counterbored bushing. I drilled out the web, as the instructions said, tapped the hole, set the bushing against the base of the die, and screw-jacked the stuck case out of the die.

This procedure ruined the case, of course — but a dedicated handloader, especially during those days when brass was scarce, hated to throw even ruined brass away. So I seated a bullet in that case and saved it as a dummy specimen. I didn't have any nefarious scheme or intent in mind — at first. But that dummy round puzzled several fellows who pawed through my loose cartridges. After I'd answered several inquiries truthfully, I turned impish.



Rimmed cases have a short useful life if they're fired again and again with excessive headspace. The firing pin drives the cartridge forward (top drawing), then chamber pressure forces the case wall hard against the chamber wall and drives its head back against the breech (2nd drawing), stretching the case and slightly thinning the lower case wall (3rd drawing). Repeated firing after firing, this repeated stretching makes the thin section of wall thinner and thinner (4th drawing). Under pressure, this band of thin brass develops a stretch ring on the outside of the case (A). Eventually, the case separates along this band (bottom drawing) when all this work-hardening makes it too brittle to stretch any more. Setting the sizing die to headspace necked cases on the shoulder — if you do it soon enough to prevent the repeated stretching — prolongs the useful life of the brass. The drawing on the next page shows how to set the sizer die to prevent shoving the shoulder back too far.

"What's this?" a fellow asked.

"Oh," I said, "that's a case for one of those old screw-in primers."

"Hmm. Yeah. Haven't seen one of those in a long time." Inspired, I offered the same "explanation" from then on.

Now and then, the questioner grinned and let me know I hadn't fooled him. But most often, the comment was something like "Heard of it, but this is the first one I've seen" or "Yeah, I used to have one in my cartridge collection, years ago. Don't know what ever happened to it. Forgot all about it." I suspect that some of those fellows later "remembered" having seen not just the case but the "screw-in primer" itself. So if you have heard of that mysterious "old screw-in primer," let all puzzlement about it pass forever from your mind.

Now — back to systematic loading.

Once my brass is clean, I'm ready to **set the sizing die** properly in the top of my press. I loosen the lock ring and run it to the top of its thread on the body of the die. I remove the decap spindle from the body of the die. (In a three-die set, this spindle is in the second die, which I adjust a bit differently. I'll get to that die later.)

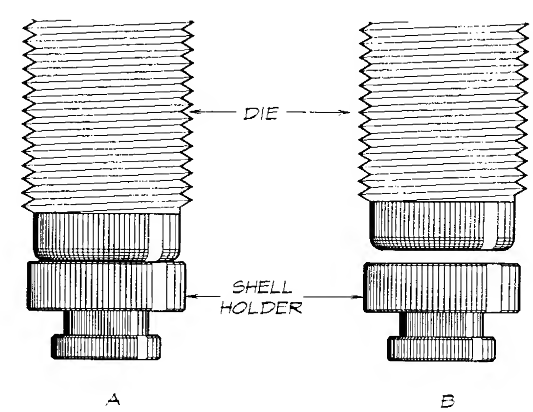
I put the correct shell holder in the top of the ram and raise it as high as it can go. I put the die in the press and turn it down far enough to touch the shell holder, then back the die out one full turn. I run the die's lock ring down against the top of the press and barely tighten its clamp screw. I lower the ram and the shell holder.

I lightly lubricate an empty case, insert it in the shell holder, and raise the ram smoothly while I guide the mouth of the case into the bottom of the die. I raise the ram to the top of its stroke, then lower the ram and remove the case from the shell holder. I wipe the lubricant off with a soft cloth or paper towel and chamber the case in my rifle. If it chambers freely, I leave the die set as it is. If it doesn't chamber fully or the bolt closes against resistance, I loosen the lock ring and turn the die down a fraction of a turn.

I lubricate the case, size it again, and see whether it enters the chamber freely. Once it chambers freely, I lock the die in position. I **don't turn the die down against the shell holder** unless this try-and-fit procedure indicates that I must. It's best to size cases just enough to let them chamber easily. Now I size all the cases I intend to load in one batch. I *resist the temptation to operate the press with slams and bangs.* I make every motion smooth and make sure the mouth or neck of each case enters the die before I force it upward.

In a set of three dies, the decap spindle is in the middle die, and its expander is different. The beveled flange on the upper end of the expander must enter the mouth of the case just far enough to "bell" it slightly —just enough to let the base of a bullet barely enter the mouth. With a sized case in the die, I screw the spindle down in the body of the die until it enters the mouth of the case and I feel resistance. I lower the shell holder and look to see whether the expander has belled the mouth at all.

If it hasn't, I turn the spindle down a fraction of a turn at a time, checking after each adjustment until the mouth is spread just enough to let the base of a bullet begin to enter the mouth of the case. I expand the mouths of all my cases.



The usual published instructions tell us to set the sizer die in the press by screwing it down into contact with the shell holder (A). This setup usually works, if there's no excessive headspace. I prefer to back the sizer die off by one full turn (B), then size a fired case and try to chamber it. By alternately turning the die down a fraction of a turn at a time, sizing the case at each interim setting, and trying to chamber it, I soon find out the appropriate setting for the die and lock it in that position with the lock ring. In that position, it may not touch the shell holder at all (B).

Priming the cases is the first step in loading my ammo. Before I open a box of primers, I check to make sure I have the proper size. The primers for American cartridges come in only two diameters (Large and Small) and two general types (Rifle and Pistol). Most good handloading manuals list the size and type that I need for each cartridge. There are special kinds within some types — magnum or benchrest — so I make sure I have exactly the correct primers. I don't use rifle primers in pistol cases, or the other way around except in a certain special process I'll discuss in another chapter.

Large primers won't begin to enter small primer pockets, and small primers won't seat in large pockets. The rifle primer is sure to have a tougher cup and a hotter flash than the same size of pistol primer. The cup of the pistol primer is thinner and may be softer than the cup of a rifle primer, so it isn't strong enough to stand up under the chamber pressure of a rifle load.

So I **get the right primers and don't mix or switch them**. Before I handle my primers, I wash lubricant and any other oil off my hands — and dry my hands thoroughly. I handle them one primer at a time, careful to insert each one open-side-up in the top of the priming punch. I prefer to prime all my cases in a separate operation, in a special priming tool instead of the priming setup on the loading press.

I never use an automatic primer feed. These conveniences can exact an exorbitant price in accidents that I easily avoid by simply omitting these devices from my bench. I've used several, both good and bad, and none was as easy or convenient to use as I thought they should be. None of them delivered enough convenience to make them worth the risk of an exploding primer setting off all the others in the feed tube or the risk of getting poked in the eye with one of those pesky little tubes jutting up and out from the top or front of the loading press.

Shooters who respect the possible dangers of powders often take primers for granted as safe enough to need no special safety precautions. Ironically, protecting primers from moisture is one source of primer accidents that can maim and disfigure. It's easy enough to store primers in moisture-free containers without risk. Their danger comes basically from two acts, neither of which is necessary for safe, dry storage: (a) taking primers out of the little packages they come in and (b) storing them in glass jars.

I store my primers in the little drawer-type packages they come in, since the compartmented trays or drawers keep them separated. Separation is the key to safety here. (Primers that touch each other are dangerous — one of the basic troubles with feed tubes that hold a stack of primers one atop another.)

Storing primers in wide-mouth, sealable glass jars is all right as long as they're still segregated in their little private compartments. Simply wrapping boxes or cartons of primers in self-sealing plastic wrap, zip-top plastic bags, or snap-top plastic boxes is better and safer storage.

Seating the primer to its full depth in the primer pocket calls for some force — but also some delicacy and a little sense of feel. Too much push on the handle of the primer seater seats the primer too forcefully and may crack or crush the delicate disc of priming compound in the cup of the primer. I squeeze the handle with a controllable force — and when I feel the primer touch the bottom of the pocket, I *stop*.

For the most accurate seating, some meticulous handloaders raise the primer-seating punch slightly, turn the case a hundred eighty degrees in the shell holder, and apply a little seating force to the primer once again.

As I seat primers, I watch for cases with primer pockets that are too loose or too tight. If a primer seats very hard, I set that case aside for now. Reaming or swaging the pocket may make it usable again. But if a primer seats very easily, I discard that case or use it to make an inert dummy cartridge. A loose pocket *can* mean the load fired in that case was too hot — so I may want to cut my powder charge back by a few grains if several of my fired cases have loose primer pockets.

Any good handloading manual is a great guide to help **select the bullets and powder** to load in my primed cases. Let's use loads from an old Speer manual as an example: I choose an appropriate bullet first, then look at the powder charges in the boxed table under that bullet in the section for my cartridge. I **don't start loading**

with any of these charges; I just study them for now. Often, the powder that most nearly fills the case to produce the highest velocity is probably my best choice.

In the Speer manual's data, for example, for the .280 Remington loaded with the 160-grain Speer bullets (spitzer, boat-tail, Mag-Tip, and Grand Slam): two powders produce top average velocities around 2,800 to 2,900 feet per second. Their top charges are 54.0 and 55.0 grains.

If I'd had no experience with this cartridge and were choosing a powder by more or less blindly by studying the Speer data, I'd try the powder that requires 55.0 grains to get top velocities — in this case, IMR 4831. If the gun shop had none of this powder, I'd then look for IMR 4350, the powder that requires almost as heavy a charge (54.0 grains) for top velocities.

Of course, I'd be guessing which powder would be best for me and my cartridge, but this system of guessing is as good as any guess can be. The chances are excellent that IMR 4831 or IMR 4350 will turn out to be the best powder for my use when I load my .280 with 160-grain Speer bullets. I look next at the lowest velocities listed for this bullet in this cartridge with these two powders. They're still the heaviest charges listed under the same velocity. I'd guess from this information that I'd be doing all right by choosing either of these two powders rather than any of the others listed in the data table under the 160-grain bullet.

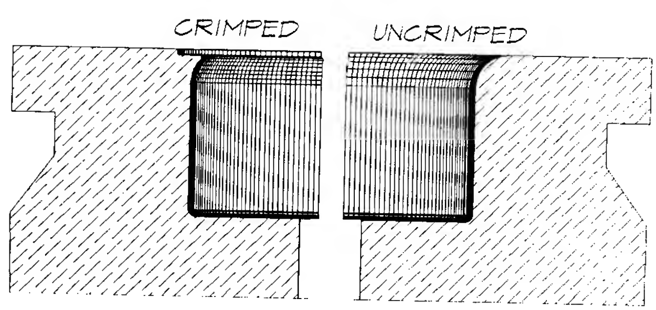
And I'd **start off with the lightest charge listed** — 51.0 grains of IMR 4831 or 50.0 grains of IMR 4350. Only after test firings showed me that my starting charge was low enough that I could safely increase it would I try a heavier charge. Some starting loads even have to be reduced after test firings show that they produce greater chamber pressures than they should. I stop shooting any load that's clearly too hot, but as long as the load seems safe enough, I shoot five or ten test rounds to see how accurate it is.

Usually, these lightest loads can be safely increased, but accuracy falls off after a certain amount of safe increase. I look first to be sure that a given load is safe; then I compare its accuracy with that of the other loads. Often, the most accurate load is a few grains lighter than the heaviest safe load.

How much I can increase a safe test load, to try a slightly hotter one, depends on the size of the cartridge and the diameter of the bore. With a tiny cartridge like the .22 Hornet, an increase of a full grain at a time is sure to get me into deep trouble before long. I increase test loads *a tenth of a grain* at a time to be safe. In a very large cartridge, such as the .458 Winchester Magnum, a one-grain increase is safe enough until my load is just a hair below dangerous. Near the top, increases in the powder charge have to be small, and I add them cautiously.

Even when I plan to use a powder measure to throw my powder charges, I **always use a powder scale** to set and to check the powder measure. I put the scale on a level surface, with its pan wiped clean and all its weights set at zero. I adjust the leveling screw at the other end (up or down) until the pointer on the end of the beam settles on the zero. I tap the tip of the beam lightly and let it settle again, just to be sure. Now I slide the weights on the beam to the combination of settings that add up to the weight of the powder charge I plan to load.

On the RCBS 5-0-5 powder scale, for example, each division under the biggest weight is ten grains. Each division under the small weight directly above the edge of the pan is a tenth of a grain. I take my time setting these, so I can **be very careful to set these weights to the right total weight.**



Never try to prime military cases without first swaging out the crimp or staking that locked the factory-inserted primer in place. Avoid primer-pocket reamers — they too often enlarge primer pockets too much to hold the new primers in tight.

Next, I **adjust the powder measure** to throw this weight of powder or slightly less. Most careful handloaders prefer to throw charges a grain or two light, then bring them up to the right weight with the powder scale. At first, I set the measure to throw a small charge. I fill the hopper of the measure nearly full with powder, then cap the canister and set it aside.

This one canister of powder is the **only one** on the bench, of course. Still, to make doubly sure I never mix powders by accident, I mark the designation of the powder on a small Scotch Post-it note and stick this temporary note on the hopper of the powder measure. (I used to use a strip of masking tape but now prefer the more obviously temporary Post-it note.) A slip of plain paper, held in place by a rubber band, does the job, too. The note goes on when the powder goes in, and it comes off when the measure is empty.

With only that one canister of powder close by, and the temporary sticker on the powder measure, I have two safeguards against mixing powders when I later add more powder and still later when I pour the left-over powder back into the canister. I can be absolutely certain I have the right canister for that powder.

If there's ever an uncertainty, I flush the questionable powder down the toilet or sprinkle it on the garden or lawn. I **never leave powder in the measure after loading a batch of ammo.** I always make sure to pour left-over powder back into the *correct* canister.

I lift the pan off the powder scale and hold the pan up against the drop tube of the powder measure. I swing the arm of the powder measure up smartly to let a portion of powder feed into the metering cavity. I pause slightly — a second or two — to let the metering cavity fill. Then I bring the arm of the measure down sharply to let the measured charge feed down through the drop tube into the scale pan. (Some powder measures work just the opposite — *down* to feed the cavity, *up* to feed the case.) I set the pan of powder on the scale (gently) and stop the worst of its side-to-side swinging by letting it bump against my knuckle until it sways only gently or not at all. I hold the tip of the scale beam down while I do this, then I release the beam to let it settle normally. If the tip of the beam settles below the zero mark or doesn't lift off its rest, the charge is too light. I adjust the measure to throw a slightly larger charge.

If the tip of the beam shoots to the upper stop or settles above zero, the charge is too heavy. I adjust the measure to throw a slightly lighter charge. I dump the powder in the pan back into the hopper of the measure — and make sure no powder remains stuck to the pan. I hold the pan up against the drop tube of the measure, drop another charge and weigh it, and keep weighing charges and adjusting the measure until the powder charge is "right on" or a little light.

I bring each light charge up to weight on the scale, and I check full charges periodically with the scale. For acceptable consistency, I sometimes check every tenth charge I throw; for better control of consistency, I sometimes check every fifth charge on the powder scale.

I process my brass by the batch — I put 'em all through one stage before I go on to the next. Some handloaders charge all their cases with powder before they start seating bullets, but most of us have found that we can make mistakes more easily that way. We're not so likely to skip a case now and then, or dump two charges into one case, if we use the charge-and-seat system — funneling the powder charge into a case, then corking the mouth with a bullet *immediately* before we pick up the next case.

If I've set my powder measure to throw the full charge, I place the mouth of a sized and primed case against the bottom of the drop tube and charge the case with powder. Whether I am weighing each charge or merely checking its weight, I put the small end of my powder funnel over the mouth of a prepared case and pour (not dump) the powder steadily into the funnel. If the powder clogs the funnel, I tap the side of the funnel lightly to loosen the powder — and pour a little more slowly next time.

Now I seat the bullet. To **set the seating die** properly, I loosen the lock ring, run it to the top of the threaded portion of the die body, and screw the die into the top of the press until it touches the fully raised shell holder. I back the die out by a turn or two, run the lock ring down against the top of the press, and tighten its clamp screw.

If I plan to crimp my cases on the bullets,

I'll have to reset the die body later. The first order of business is to set the seating stem for the correct total length of the cartridge.

I remove the seating stem from the die (if it comes out through the top) or back it up to the top of the die as far as it'll go. I put the charged case in the shell holder and hold a bullet in place on the mouth of the case while I raise the ram, guiding the bullet and then the case into the seating die. I raise the shell holder all the way. I insert the seating stem into the seating die (or run it down from its far-up position) and screw it down until it touches the bullet. I lower the shell holder slightly, turn the seating stem in a few turns, then raise the shell holder. I lower the shell holder and check to see whether the bullet is seated nearly to its proper depth.

I continue adjusting the seating stem downward by slight partial turns until the cartridge is just a hair longer than the desired over-all length, then I continue adjusting by smaller amounts until the over-all length of the cartridge is just right or a bit shorter.

If I don't plan to crimp the mouths of my cases, I go ahead now and finish loading all my prepared cases — I **charge one case at a time and seat a bullet in it** right away. If I want to crimp the mouth, I back the seating stem several turns out of the die and loosen the clamp screw in the lock ring. I turn the lock ring a few threads up the body of the die.

I put my first correct-length cartridge in the shell holder and raise the ram all the way. I turn the seater die down easily until I feel resistance. I lower the shell holder slightly, turn the die down by a quarter of a turn, and raise the shell holder. As the cartridge comes all the way up, the die puts a slight crimp on the mouth.

I lower the shell holder and look to see whether the crimp is adequate. If it isn't, I turn the body down by a slight partial turn and raise the cartridge into the die again. I check the crimp again and adjust the die in this way until I get an adequate crimp. I don't overdo it just to be sure! With the cartridge in the die, I turn the lock ring down and tighten it — then turn the seater stem down until it presses firmly against the bullet and tighten its lock ring.

I charge a case; I seat a bullet in it. I charge another and seat a bullet in it — and keep on at it until the job's done. Then I wipe each of my brand-new handloads with a soft cloth or paper towel, and check each case for a split neck. I set all the split cases aside for a later session with a good bullet puller.

If my cases are still relatively clean and bright after I fire them, I wipe them well and either load them right away or package them in something that will keep them clean and put them away for loading later. If they've gotten too dirty for a simple wiping to clean them, I tumble or vibrate them, clean them up, and either store them or load them.

Whether you adopt this handloading system *in toto*, modify or adapt it to your specific use, or develop a better procedure, the more experience you get with a well planned system, the more satisfaction and success you'll enjoy with your custom cartridges. Abundant handloading experience and a basic understanding of the operating pressures of cartridges are practical prerequisites for designing custom cartridges.

The next chapter will introduce you to the basics of operating pressures. Later, Volume Two (*Loading and Testing Custom Cartridges for Rifles and Handguns*) will cover advanced and experimental handloading.

Chapter 3

This genie's bad when he's mad.

THE POWDER gas that propels a bullet is a rebellious slave that works best on the brink of a breakout, a genie in a stout bottle that he can shatter to shards in an instant if he gets mad enough. His rage is impartial. When he gives the bullet a sharp kick, he kicks the cartridge case, the breech, and the barrel just as hard. When he behaves, only the bullet is potentially his weapon of destruction.

The firearms and ammunition manufacturers fear this genie for the ogre he can become, so they lay on all the attention it takes to keep him safely enshrouded in brass and steel. What they fear most are the possibility that he'll escape and what he'll do as he breaks free. He's easy to put into the bottle when he's asleep inside those kernels of powder, but just as no one can put a meow back into a cat, no one can put this wild genie back into his bottle once he wakes up and pops the cork. But you can make sure he doesn't pop your bottle too.

Any firearm can kill or cripple, maim or mangle, at either end and sometimes off to the side, by intent or by accident. Any firearm is a powerful servant just itching to do mischief. You can't let your vigilance get sloppy as long as something hard and heavy can come romping out the front end of the barrel and make all kinds of nasty things happen to the wrong things or the wrong people. Once you decide to load your own custom cartridges and especially once you decide to design one, you take on the responsibility to know, understand, and consider a few of the basic facts about this powerful servant that makes your cartridge work while he waits for an opportunity to break free. Giving give him free, productive rein without turning him loose to become an ogre and wreak horror requires that we know him and understand some of his ways. To know him is to love him, to a point — beyond that point, familiarity leads to potentially suicidal contempt.

On a television program I've been watching while I'm writing this, someone just said — about something altogether unrelated to this — "Accurately assessing the danger is a vital necessity." He could just as well have said that about the powder-gas pressures that make cartridges work and threaten to wreck them.

The bullet is an inert, useless object until the propelling force inside the firearm makes it move. When we talk about chamber pressures, we're really talking about this propelling force. To compare the force that we actually get and the most we can safely use, we measure these forces as they're applied against a standard surface area. This is what pressure is: force (usually measured in pounds in the United States) per standard unit of area (one square inch).

We speak of pressure as if it's singular, but it's the relationships between pressures, plural, that produce the performance we want — movement at great speeds over great distances. We have to increase the internal pressure to far more than the case of the cartridge can withstand without the support of a strong breech and barrel.

The only way we can get into trouble with this is to increase the internal pressure to a peak level beyond what the gun can stand indefinitely. It's easy to get into this kind of trouble, but it's just as easy to avoid it — just apply a little common sense to a basic understanding of chamber pressures and how they behave.

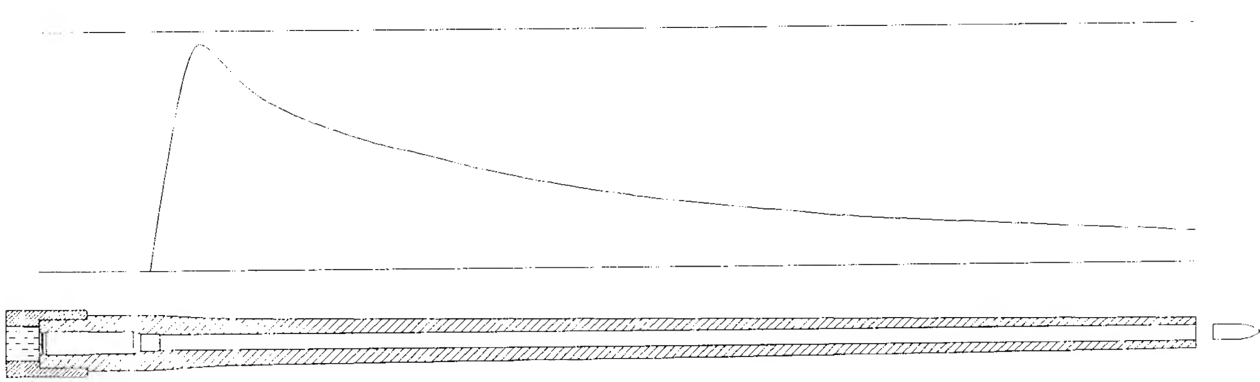
We need a lot of pressure produced almost instantaneously, so basically the problem is to get enough pressure to overcome several forms of resistance to the movement of the bullet, and thus to propel it without getting too much pressure too fast. This tricky business is safe enough until we get close to the limit of the protection the gun gives us against these forces we're using. The gun, like a gasoline engine, burns a combustible substance to generate a great internal force to produce guided movement — in such a violent way that it seems determined to destroy itself.

To use the force thus produced, we operate in a narrow range of pressures just short of the point where the destruction of the gun is the next thing to expect.

The way powder burns is a subject in itself. Let's touch just the high points. First, the two extremes: unconfined, in the open air, powder burns exactly like old-fashioned nitrate movie film or a ping-pong ball (because it's the same stuff), not much more violently than so much fine, dry, shredded wood, because the gas thus produced meets no resistance to its expansion (just mild atmospheric pressure), and it simply drifts away gently.

But when it's totally confined, with no easy outlet for its expanding gas, powder burns less patiently and slowly. The gas first released by burning powder can't go anywhere. It increases the pressure inside the confined space and thus makes the combustion of the powder pick up speed, producing more gas that further increases pressure and combustion. This combustion increases until something gives way before the thrust of the gas pressure, relieving the confinement of the powder gas, or until there is no more powder to burn.

In either case, confined powder is violent. The more it's confined, the more violent it is. It releases the same amount of energy either way, but it releases that energy much faster under closer, tighter confinement. In open air, it burns less violently than it does inside a bucket — and it burns more violently still in a chambered cart-



The army tested the interior ballistics of a charge of about 50 grains of Pyro DG powder pushing a 150-grain M1906 flat-base .30 bullet down the barrel and out the muzzle of a Model 1903 Springfield rifle at about 2,700 feet per second. Crusher discs along the test barrel recorded the pressure at each point in the bullet's travel. My drawing shows a 24-inch sporter barrel, with the army's pressure curve aligned with the base of the moving bullet. The lower horizontal line represents zero pounds per square inch, and the upper horizontal line represents 60,000 pounds per square inch.

ridge. It's most violent when it burns in a small and tightly constructed container that doesn't give its gas any room to expand.

The behavior we want lies somewhere between the two extremes of open-air burning and a bomb explosion, but of course somewhat closer to the behavior of powder burning under total confinement. The danger comes when we closely approach the second extreme. In our handloads, anything that increases the confinement of the powder — by either reducing the volume of its enclosure or increasing the resistance to its release — brings us closer to danger. There are many ways to do either of these. Also, anything that gets the reaction off to a faster start makes pressures higher. This is easy to do, too —you're likely enough to do it without trying.

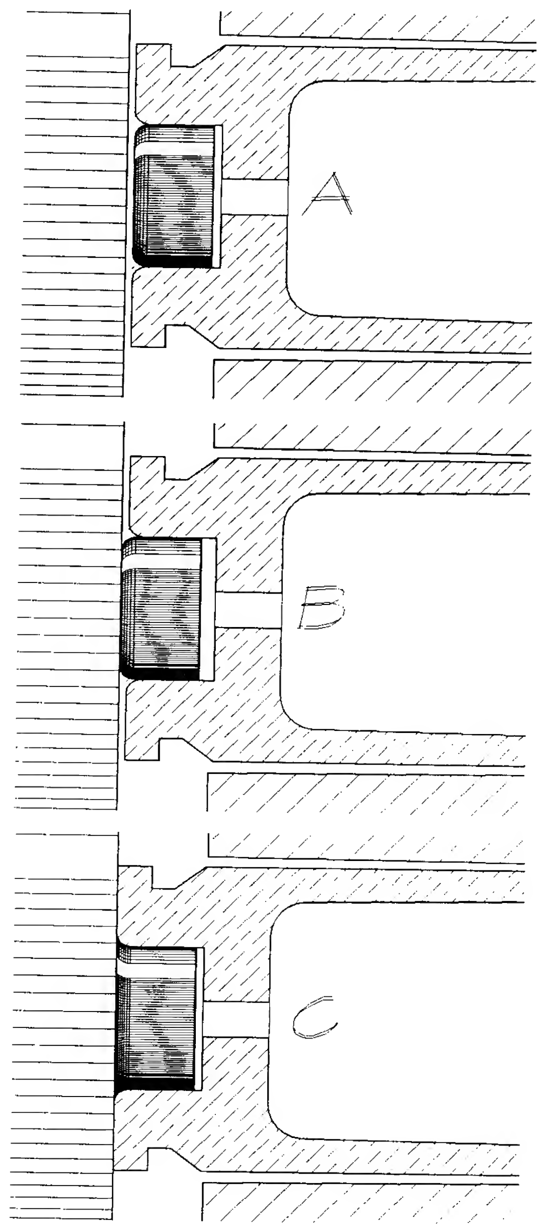
One gun's limits of strength and endurance aren't likely to be exactly the same as another's — but more important is the fact that cartridge cases, the weakest link in every normal firearm, vary in strength as much or more. Two other facts also make it impossible (first) to determine the exact safe limits cartridge cases can stand for indefinite periods under normal circumstances, then (second) to engineer all the variables of cartridge and gun to produce pressures that stay within those limits.

We can't emulate the technique advised by the lady on the subway, who told another rider how to get off at the stop he wanted: "Just watch me and get off a block before I do." We want to get off before she sits up straight and starts gathering up her purse and packages, whether we're three blocks short of where she's going to get off, or four or even five or more.

The first fact to remember is that there are simply too many variables, some hard to predict and others impossible to predict, to be identified, studied, and controlled as closely as such a degree of ballistic engineering would require.

The second fact is that whenever a number of variables work together, they sometimes add their effects and sometimes cancel or compensate for each other's effects.

Additive or cumulative variables can combine to reduce or to increase pressure, and there is no way to tell ahead of time (a) whether they will act cumulatively or compensatively, or (b) whether cumulative variables will increase or decrease pressures. The more variables there are, the better are the chances that they will act compensatively — that some will tend to raise pressures, others to lower them — so that variations in pressure from one shot to another, or from one rifle to another with the same ammunition, more or less even out over the long run.



Low-pressure loads can make you think your pressures are "excessive." The firing pin pushes the round forward (A). The primer's force pushes it to the rear (B) before the powder produces enough pressure to drive the case backward, hard against the breech face (C), and flattens the primer cup into the rounded mouth of the primer pocket.

But the closer our handloads approach maximum pressures in one rifle, the greater danger there is that they will be dangerously high in another rifle — because of the risk that cumulative variables will in some instances work together to raise peak pressures far enough to cause some damage or injury.

The handloader who thinks bullet weight, kind of powder, and amount of powder are the only variables to consider in loading a given cartridge is in for a shock. Every component available for that cartridge is a variable. Every chamber reamed for that cartridge includes several variables. The components can be put together in a seemingly infinite variety of combinations, and every combination is a bunch of variables before it goes into the chamber.

Chambering the cartridge introduces still more variables. All the paraphernalia and techniques of handloading are variables, and the person operating the handle is a multitude of variables. So is the weather, at both the time we load and the time we shoot these rounds.

There are just too many variables for anyone to cover them all. We can get the gist of them all by looking at the main ones.

In the cartridge, the most important component is the case. It is both a container and a seal; it is also a major variable. Its hardness determines how much pressure it can withstand without letting go and spilling destructive gas in the wrong direction. Its dimensions help to determine the size of the cavity that initially confines the powder. If the walls and base of one case are very thick, its powder cavity is not only smaller than in other cases of the same caliber but can easily be smaller than the inside of a smaller cartridge that has thinner walls.

Primers are not all alike. Even those in the same box vary enough to make chamber pressures fluctuate. Different batches vary still more, and different types and brands vary most of all. One company's "regular" primers may be hotter than another company's "magnum" primers.

A thinner or softer metal in the cup of one brand of primer may allow faster ignition than a competitor's primer. A thinner or softer cup can withstand less pressure than another primer's harder, thicker cup can take.

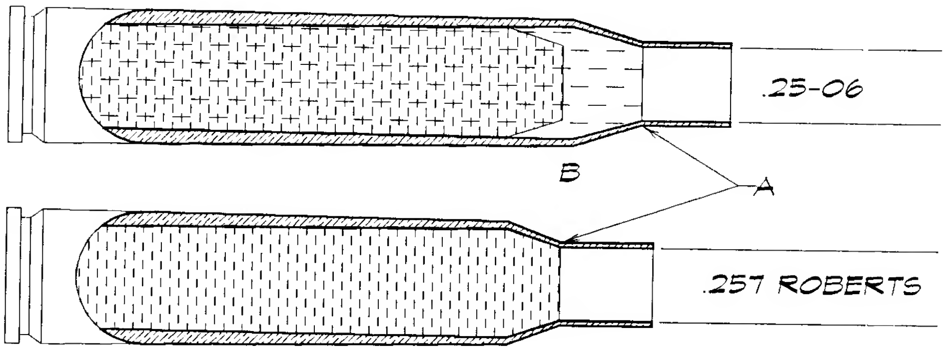
Other variables can make pressures soar — maybe a good many that we don't even know about yet, and certainly more than I can cover here. The main thing to remember is that pressure goes up whenever any variable in the cartridge, the gun, or the environment tends to do one or more of these things:

¤ cram the powder into a smaller cavity
¤ make the powder burn faster
¤ increase resistance to release of powder gas
¤ let powder gas escape in the wrong direction or at the wrong time
¤ make the gun weaker (lower its maximum safe pressure)

A given powder charge produces higher pressures when it burns in a smaller space than an equal charge produces when it burns in a larger space. A charge that produces high pressures in the .30-06 produces even higher and probably dangerous pressures in the smaller .308 Winchester — and it's sure to make a bomb out of a chambered .30-30 case. Any of several variables, especially if they work cumulatively, can reduce the net powder capacity of the .30-06 almost to the lower capacity of the .308 case. They can also reduce the capacity of any other case in the same ways.

A .308 Winchester case formed by shortening a .30-06 is likely to have less capacity than a factory-made case for the smaller cartridge. The walls of the home-formed case are likely to be thicker toward the mouth than the walls of the factory case. Since the outside dimensions vary almost not at all, any variation in wall thickness affects case capacity and alters pressures. It isn't likely that two brands of cases for the same cartridge have exactly the same capacity, since the wall or the web of one brand is almost certain to be thicker. Extra thickness reduces capacity (all the outside dimensions stay the same, remember). A thicker neck wall grips the bullet tighter than a thinner neck wall. This tighter grip (called bullet pull) lets pressures build to a higher peak as they overcome the inertia of the bullet — and bullet pull — to start it on its way down the barrel.

One brand of cases may hold as much as four to six grains more powder than those of a different brand. Even different batches of the



A powder charge that would be hot in a .257 Roberts case would produce lower pressure in a .25-06 case. A maximum charge for the .25-06 would be far over maximum in the .257 Roberts. In this drawing, I've superimposed the powder cavity of the .257 Roberts (vertical hatch) over the cavity of the .25-06 (horizontal hatch), using the bases of their necks (A) as references. The difference in their powder cavities (B) is both obvious and a significant influence on their pressures.

same brand vary somewhat in capacity, and there is usually some measurable variation between cases in a single batch. The .308 Winchester (7.62mm NATO) is notorious for this.

My old friend Charlie O'Neil used to weigh his cases one by one, scratch the weight of each case into its side, then load each case with its own powder charge tailored to its net powder cavity.

A heavier powder charge offers up more potential energy; it also increases its own confinement over that of a lighter charge in the same powder cavity.

Powder scales don't invariably measure in absolute grain weights (scales vary in accuracy, and so do the techniques and care you use in weighing powder with them). Your charge of fifty-seven grains of H-380 for your 7mm Remington Magnum probably isn't exactly the same amount of powder as your pal's equally carefully weighed charge of H-380. The difference may be slight, but this variable works two ways to affect pressures.

The final outside dimensions of the cartridge being fired are essentially those of the chamber it's fired in. My chamber may be a good bit bigger than yours, making my safe maximum load a good bit hotter in your chamber — maybe even hot enough to blow your primers out, braze the head of your cartridge case to the face of your bolt, and spit hot powder gas back at your face. My best safe load could be poison for you.

Residue left from earlier firings reduces the capacity of the case a little. Wads and inert fillers reduce it even more. But one frequent reducing factor is a bullet that has to be seated deeper in the case — because the chamber throat is too short, or the lands are too high, for example. This is a different matter from a bullet seated deeper but fired in an equally long throat. In such a case, two variables act compensatively. The increase in the distance the bullet must travel, before it engages the rifling, substantially offsets the reduced powder capacity. For example, any load developed in a .350 Remington Magnum rifle made on a Mauser action, with the chamber throated to let the bullets be seated out far enough to avoid intrusion of the base of the bullet in the powder cavity, is certain to develop much higher pressures if the same charges of the same powder are loaded in cases to be fired in a Model 600 Remington carbine. The carbine's cartridge has to be shorter because of the shorter action and the necessity for loading the bullet with its base far down into the powder cavity.

If the free bullet travel is the same in both the custom Mauser and the Remington carbine, equal charges of the same powder are confined differently within the two cartridges — more confined in the Remington than in the Mauser.

The faster any powder burns, the faster its pressures go up — whether the faster burning is a result of the powder's combustion properties or of some other variable that makes any powder burn faster in one situation than in another.

Any reduction in the powder capacity of the case (which means increased confinement of the powder) makes powder burn faster. So do a good many other things.

The heavier powder charge raises pressure in two ways — by its greater energy content and by reducing its own combustion space (each half of the powder charge crowding the other half, if you will). Powders vary from one batch to the next. A livelier batch gives higher pressures with a given charge, simply because it burns a little faster. It may also be more easily ignited, and if the primer is hotter than the one used by the other fellow in his maximum load, the pressure is probably higher than his, too.

The effect of a livelier primer, by the way, is more pronounced at higher chamber pressures: the higher the pressures are, the more a hot primer can raise them.

Given the same capacity, charge weight, powder batch, bullet, seating depth, and so on, even an increase in the size of the primer vent can probably raise pressures by increasing the ease and rate of ignition — and therefore how fast the powder burns.

In fact, anything that makes powder ignite more easily makes pressures go up. Hot weather does it, especially if you worked up your load in the middle of the winter, in a chilly basement. Higher temperature in the chamber before the primer flash, even from the barrel being heated by earlier firings, means that less heating of the powder is required for the primer flash to bring it up to ignition temperature. Hot *anything* lights easier than the same stuff cold.

Primers vary, too. They make pressures and velocities vary from one shot to the next, and they're sensitive to such things as how they are seated and how hard the firing pin hits them. If I develop a load while seating my primers "soft" so that they cushion the blow of the firing pin more than they should, another batch of the same loads would be hotter if I seated the primers better and thereby got a hotter flash from them.

And if I exchanged a soft firing-pin spring for one with more authority, I'd get better ignition. Any increase in the heat or turbulence of the primer flash means easier ignition, faster burning, higher pressure.

Also, the longer that powder is confined during the firing cycle, the more its burning rate increases. Resistance to the movement of the bullet, which is overcome only after some delay and further build-up of pressure, thus increases the burning rate of the powder until movement of the bullet relieves some of the pressure build-up. A crimp in the mouth of the case, a tighter case neck, the bullet resting against the beginning of the lands, a tight chamber neck, a case that is too long and thus unknowingly crimped into the bullet, an oversized bullet, a sealant to cement the bullet in the neck — any of these causes pressures to rise.

Even if there were no friction between the bullet and the sides of the bore, the bullet — by virtue of its mass and inertia — would resist the release of the powder gas. Its mass, which we can consider its weight in this discussion, can move only at the expense of force (or pressure). Mass or weight is thus a source of resistance. Friction is of course there, too. A tight case neck raises pressure; so does a crimp. If the throat of the chamber is abrupt rather than gradual, pressure is higher than it would be with a more tapered throat or with a long free-bore. And obviously, if the bullet is larger in diameter than the bore is, pressure goes up because of the greater force and longer time required to drive the bullet fully into the rifling.

After the bullet gets started, friction offers less resistance, but it's still there, still resisting movement of the bullet and requiring pressure to propel the bullet down the barrel. A bullet with a longer bore-rubbing surface, a thicker jacket, a harder jacket, or a harder core can obviously produce more friction in its travel down the barrel. If the surfaces of the lands and grooves are rough, this roughness produces still more friction. Jacket material scuffed off the bullet by barrel friction remains inside the barrel, very slightly reducing its diameter but also increasing the friction between bullet and barrel.

A somewhat different kind of friction arises

from the twist of the rifling — a short twist offers more resistance to release of the powder gas. Release depends upon the bullet's movement toward the muzzle, but the bullet has to move not only forward but also in a rotary motion to follow the rifling and thus to move forward. More force, therefore more pressure, is necessary to produce this rotary motion.

Because of the bullet's rotation inside the barrel, the surface of the bullet travels farther in its spiral path than it would if the twist were more nearly straight. And its surface is rubbing against the inside of the barrel for all this greater distance. To see the effect of slower and faster twists, compare the extremes — a smooth bore (no rifling at all) or straight longitudinal lands and grooves (no twist at all) would offer much less resistance to the travel of the bullet. A set of deep screw threads in the barrel would offer a great deal more resistance.

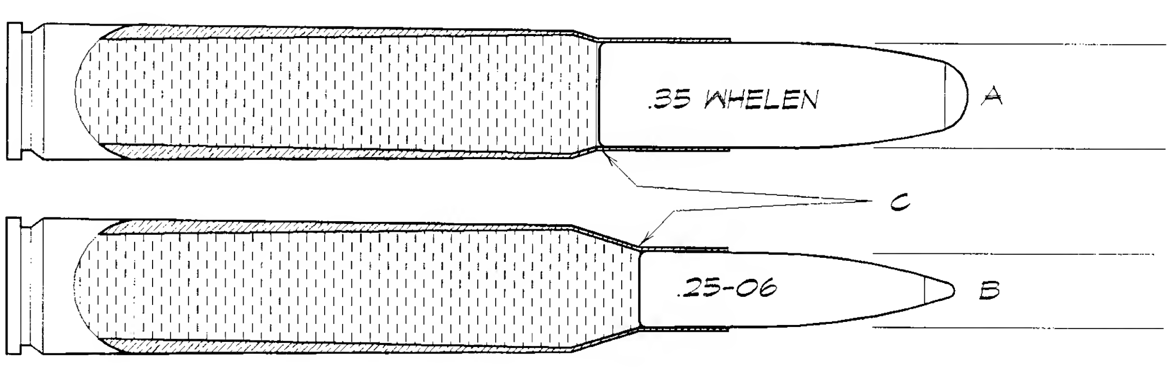
Slower and faster twists are nothing more than moderate versions of these two extremes. Fortunately, rifling twist has only a slight effect on pressures, so it isn't a serious complication unless it's one of several influences that in a given instance are combining to increase pressures. Usually, a complex of influences tend to cancel each other — while one or more tend to increase pressures, another or others tend to reduce them. Occasionally, all variations in pressure influences act together to raise or reduce pressures — only a nuisance when they dampen pressures but potentially dangerous when they hoist them.

Some handloaders borrow loads from data for other cartridges of similar capacity — poor judgment and a dangerous practice. A small escape passage resists the release of powder gas much more than a large passage does; a small bore is clearly a smaller escape passage than a large bore. A given powder charge in a given powder cavity thus produces more pressure in a small-necked cartridge than it does in the large-necked but otherwise similar cartridge. Data in Hodgdon's 26th data manual offer some good examples: the .270 Winchester and the .30-06 have virtually identical powder capacities. They differ only in the sizes of their escape passages (bores). With the same powder (H-414) and the same bullet mass (150 grains), the .270 produces 2,100 copper units *more* pressure, with eight grains *less* powder, than the .30-06 does.

.270:
50.0 grains of H-414
2,800 feet per second
50,800 copper units of pressure

.30-06:
58.0 grains of H-414
3,043 feet per second
48,700 copper units of pressure

The body of the .35 Whelen case (A) is exactly the same size as the body of the .25-06 case (B), but their net capacities (with the bases of their necks, C, as a point of reference) and other pressure determiners are not the same. The .358 barrel lets pressures drop faster than the .257 barrel, but the .35 bullet is heavier than the .25 bullet. Obviously, a safe charge for one of these cartridges is almost certain to be dangerous in the other.



In the .270 Winchester, fifty-eight grains of H-414 would turn up fierce pressures indeed.

You're getting the feel of all this when you notice that all these variables are closely related: a reduced powder cavity increases the burning rate of the powder. So does increased resistance to the release of the powder gas. These things vary a little from one round to the next, even in the most carefully loaded ammunition.

Variation itself is nothing to worry about, as long as it's not too great. Good brass, well supported at the breech and not too old, can safely handle wider variations in pressure than good accuracy permits. But poor brass, or even good brass poorly supported, often lets go easily.

Also, good brass sized wrong can easily let go, even with moderate loads. Many printed instructions for adjusting loading dies tell you to screw the sizing die down against the shell holder. Often, sizing dies set this way push the shoulders of rimless cases back far enough to create excessive headspace, maybe a little and maybe a lot. The shoulder gets moved forward again (or the base gets moved to the rear) when pressure inside the case moulds it to the chamber.

In time, cases mistreated this way come apart and let their propellant gas go wild in the wrong directions. "Safe" pressures are safe only when the case holds them. If a faulty case lets them come back through the breech, they're dangerous. High-pressure loads in questionable cases are always questionable, however "safe" they may be otherwise. Setting the shoulder back with the sizing die and then blowing it forward again leave bad-enough results with mild loads and worse results when pressures are higher.

An unfortunate piece of advice is the often-printed "reduce maximum loads five percent *and work up*." This advice gives the dangerous impression that the handloader can safely load — for his gun — charges heavier than ninety-five percent of the charges listed as maximums in another gun. The maximum safe load in the test chamber can be excessive in your chamber.

Your chamber and barrel are certain to be a bit different, and your cartridge is even more likely to be different in some way. You're sure to be using a different lot of powder, which may require a lighter charge to produce the same pressures. Your primer may be hotter than the one used in the test loads. Your bullets may be a different brand — with different influences on chamber pressure.

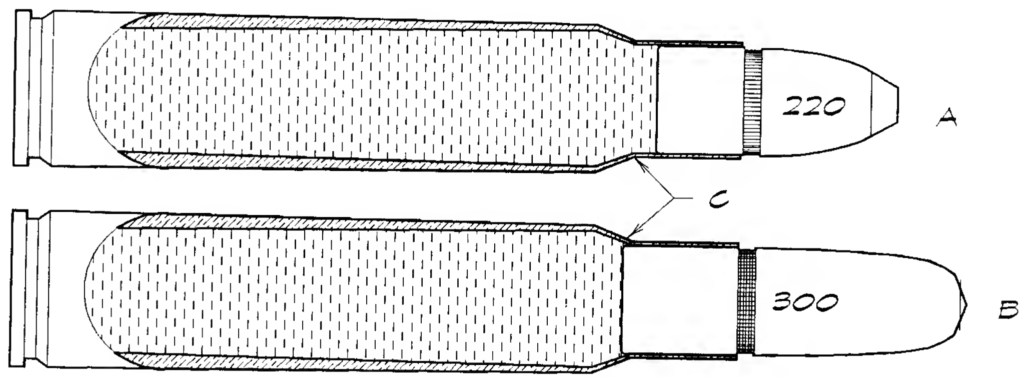
I'll never forget my first loads in a famous wildcat .30 cartridge. I reduced the originator's top load of a relatively slow powder by several grains — about ten percent. My loads swelled primer pockets so large that I could drop a primer into the pocket, then upend the case and dump the primer into my hand. I had to reduce his load by about twenty percent to get my peak pressures down to a safe level.

I developed and loaded a below-maximum load that did well in every .30-06 rifle several friends used it in — then another friend tried it in his imported sporter and got unmistakably excessive peak pressures. We found that his barrel had extremely high lands. All its other chamber and bore dimensions were right. If that load had been maximum for all those other rifles, it would have been wildly excessive for his.

A maximum load in one chamber can exceed the safe maximum for another chamber reamed for the same cartridge. So the advice *should* be something like this: "reduce maximum loads at least five percent at first; then increase or cut back as pressure signs indicate." A still better move is to drop back ten percent, at least with some powders and cartridges, and work from there — not *up*, necessarily, but in whichever direction pressure signs tell you to go.

There is no way yet known to man that permits us to predict how all these many variables will intertwine, cooperate, or do battle with each other, so it is nothing more than good sense to drop back on borrowed powder charges — no matter how sound or reliable the source of these load data may be, nor how stable the performance of those loads may be in some other gun — for the simple precaution of allowing those unpredictable variables some "running room," just in case they happen to operate cumulatively and in the wrong direction, raising pressures.

There is always this danger, even when all the variables are moderate, with nothing out of the ordinary. But let anything happen to be out of the ordinary, and one variable alone can be ruinous all by itself.



In this .375 cartridge, the shorter 220-grain Hornady bullet (A) doesn't seat to the base of the neck (C), but the 300-grain Hornady (B) does, when both bullets are seated to the rear edges of their cannelures. So — while the gross capacity of this case is of course always the same — the net powder capacity with the lighter bullet is several grains more than the same case loaded with the longer and heavier bullet. Also, the greater weight of the 300-grain bullet limits the maximum safe charge to a few grains less powder.

Pressure is an unruly pet as well as a productive work horse. It has to be treated right, with caution and discipline, to keep it working in its proper role. Thus controlled, it poses no danger to handloaders. Let's look at live gas pressures in action, from their birth at the firing pin's impact to their final explosion (muzzle blast) when the bullet exits the muzzle. This, called interior ballistics, covers a very short time, but a lot goes on in that moment before the bullet comes out the muzzle.

When the firing pin falls, its impact drives the entire round forward a tiny fraction of an inch until its headspace device — case rim, belt, mouth, or shoulder cone — meets the resistance of its contact surface in or on the breech. This slight forward movement of the cartridge, called drive-in, leaves a tiny space between the head of the case (also the face of the primer) and the face of the breech.

Headspace, in shooting lingo, has come to refer to the way a cartridge is positioned in the chamber, ready for firing (as in "a rimmed case headspaces on the rim"). It has also come to mean — in the definition adopted by the Sporting Arms and Ammunition Manufacturers' Institute (SAAMI) — "the distance from the face of the closed breech of a firearm to the surface in the chamber on which the cartridge case stops."

SAAMI uses another term, *head clearance*, for "the distance between the head of a fully seated cartridge or shell and the face of the breech bolt when the action is locked."

Originally, headspace — named after the space between, say, the tomatoes or peaches and the underside of the lid in a jar of food canned at home — referred to this tiny space left between the face of the breech and the head of the fully forward case. Whether you call it *headspace* or *head clearance*, never forget or ignore this thin space between the case and the breech face.

When the forward movement of the case stops, the tip of the firing pin indents the base of the primer cup. This indenting of the thin primer brass probably begins when the firing pin strikes the face of the cup, but it's "soft" or incomplete while the case is moving forward and "riding with the punch" of the firing pin.

Inside the primer cup, the tiny bulge forced forward by the firing pin crushes the frangible, sensitive primer pellet against the peak of the primer anvil. The legs of the anvil rest solidly on the floor of the primer pocket, so the anvil resists the thrust of the firing pin and the inner bulge it forms in the primer cup. The pellet of priming compound crumbles between the anvil and the inward bulge of the primer cup.

Crushing the pellet causes the priming compound to react chemically and violently. A furi-

ous flame and flame-hot particles spew through the primer vent to stir, heat, and ignite some of the powder kernels inside the body of the case. But the primer vent is only a small opening in the septum or web of brass between the primer pocket and the powder cavity. The powerful primer force pushes equally hard against the inner circumference of the primer cup and the floor of the primer pocket.

While the powder charge is unlit or first being ignited, the case still lies forward in the chamber, with that thin space still between the primer and the breech face. The force of the reaction inside the primer pocket pushes the primer cup toward the face of the breech. The space between the primer and the breech face lets the primer become a tiny piston. Its own internal force drives it backward, to protrude slightly from its pocket.

If the powder is slow to ignite, or if the space between case head and breech face is larger than it should be, the pressure inside the primer can also swell the sides of the protruding section of the primer cup. When the powder gas inside the case later drives the case hard against the breech face, this swollen wall of the primer cup flattens again, like the "bumping" operation that forms the rim on a rimfire case. Extremely low peak chamber pressure or late ignition, plus a little too much headspace, can give the primer this false sign of "excessive chamber pressure."

You can produce this protrusion of the primer, but not the later bumping, by firing a primed and chambered empty case.

During the instant of the primer's glory, some of its fire spews through the primer vent into the powder cavity. If the powder charge is near the optimum load density (the ratio of the volume of the powder charge to the volume of the powder cavity), there's just enough space among the powder kernels to let the primer flame and fire-hot particles flash forward among these kernels to stir them and to ignite a significant number of them.

The primer's turbulence — its ability to stir the powder — is as important as its heat, since it's necessary to ignite more than just the few powder kernels just beyond the primer vent. The primer stirs and ignites the powder. The stirring lets the flame reach most or all the powder kernels in the case — to ignite many of them, not just those few kernels immediately in front of the primer vent.

Larger kernels, with a larger ratio of volume to surface, take more flame and more time as well as more turbulence to stir them. This is essentially the reason for magnum primers — to ignite large charges of large-kernel powders, especially when a special coating (applied to delay or slow ignition) controls the combustion rate of the powder. This is also one of the reasons rifle primers are significantly hotter and more turbulent than handgun primers.

Smaller powder kernels, with their smaller ratio of volume to surface, ignite more readily. This is why handgun primers are milder than rifle primers, and why regular or standard primers are at least theoretically less tempestuous than magnum primers.

Powder burns hot. When the fellows in the labs say it burns "with a high flame temperature," they mean it burns hot. When the first powder kernels burn, they in turn raise the amount of heat (measured in British thermal units, Btu) and the quality of heat (temperature, measured in degrees Fahrenheit or Celsius) inside the case. This heat warms and ignites any powder the primer hasn't already set ablaze, and all this burning powder produces still more heat.

The powder burns slow at first, then faster and faster as the gas it generates increases the pressure inside the case.

Burning powder produces a composite gas, and it's hot, too — over 3,000° Fahrenheit. The hotter any gas becomes, the more room it wants, so this hot gas expands madly. It vastly and rapidly increases the pressure inside the cartridge. The increase in pressure makes the powder burn faster, so it produces more hot gas, which further increases pressure, making the powder burn still faster and turn out still more hot gas, which in turn keeps the process going on and on.

As both heat and pressure increase each other over and over in such a short time and in such a tiny space, something has to give. But before the bullet moves, this extreme internal pressure does a few things to the case and the primer. The growing pressure expands the case

until the walls of the chamber stop its expansion.

The pressure continues to build. It pushes the base of the case to the rear, presses it hard against the face of the breech, and pushes the primer hard against the breech face and the tip of the firing pin. This movement of the case is called drive-back — the opposite of the earlier drive-in produced by the impact of the firing pin.

As pressure continues to rise toward its peak — thousands of pounds per square inch — it presses the comparatively soft brass of the primer cup and the case against the much harder steel of the firing pin, breech face, and chamber wall. This pressure can be great enough to imprint, on the primer cup and case, the tiny marks left on the bolt face and the chamber wall by the machine work that formed those surfaces.

An extremely high peak pressure leaves pronounced imprints of these tool marks on the primer cup and the case. Loose grit stuck to the chamber wall can be embedded in the side of the case. The concentric little tool furrows on the face of the breech around the firing-pin opening leave matching concentric ridges on the face of the primer cup.

And still the gas pressure increases. But in about a ten-thousandth of a second, it overcomes the inertia of the bullet. The bullet starts to move, slowly at first but then faster and still faster. The first slow and relatively reluctant movement of the bullet must overcome the inertia of its unmoving mass, the grip of the cartridge neck — called bullet pull — then an instant later, the resistance of the rifling.

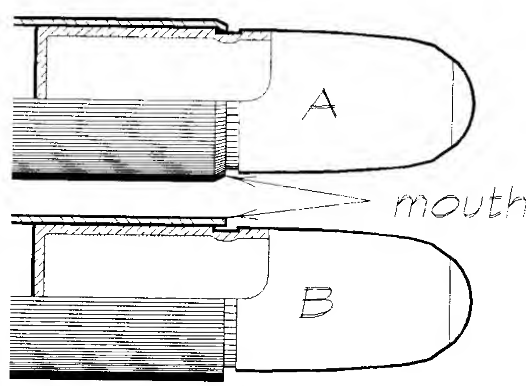
The first movement of the bullet also increases the space in the case behind the bullet. This space will increase when the bullet travels down the barrel, relieving much of the powder-gas pressure behind the bullet — but not yet. The first bullet movement and the increase in the enclosed space are too slow to reduce the pressure. Pressure continues to rise, though not quite so fast as before.

The bullet moves forward too slow to let the propulsion gas expand as fast as it could if the bullet didn't impede it. The base of the bullet therefore swells, squeezed between the pushing gas and its own resisting mass. The bullet flies forward into the throat, meets the added resistance of the rifling, and loses much of its momentum. The powder gas still thrusts against its swollen base, expanding it further. The thrust of the propelling gas must swage the expanded base into the throat, then into the rifling.

The bullet doesn't stop moving forward, but its forward motion slows dramatically until the gas swages it into the bore and accelerates it down the barrel. Pressure continues to rise until the bullet enters the rifling and travels far enough down the barrel for the increasing space behind it to begin reducing pressure.

As the bullet accelerates, it leaves behind more and more expansion room for the propelling gas. Pressure begins to drop, then drops more and more rapidly. The gas continues to expand. It exerts less and less force on the base of the bullet — but less and less force is necessary as the increasing momentum of the bullet requires less force to accelerate the bullet.

How rapidly the speed of the bullet can increase depends now on the friction between the bullet and the surfaces of the bore — also on the twist of the rifling. To understand the effect of the twist, remember the relative effects of two ridiculous extremes already mentioned — a bore



This drawing shows identical bullets seated to the same depth in the necks of identical cases. With identical powder charges inside both cases, the crimp in the mouth of round A will increase its "bullet pull" (resistance to expulsion from the case) and produce significantly higher chamber pressures than in round B. In round B, the lighter bullet pull will allow the bullet to move under a lower chamber pressure.
Maximum loads (and even some submaximum loads) developed, tested, and proven safe in cases without mouth crimps are certain to be dangerous in cases with crimped mouths.

"rifled" with straight lands parallel to the axis of the bore, and a bore with deep, coarse screw threads instead of typical rifling (say, two or three turns per inch). In the first extreme, there's no twist, only a straight course of travel for the bullet's bearing surface.

In the second extreme, the twist is so great that a bullet would have to revolve two or three times to go forward an inch. Its bearing surface would have to travel two or three circumferences of the bore for each inch of forward movement. A screw thread would make the bullet a bore plug, much like the screw that plugs the breech of a muzzle-loader. The bullet probably would not go anywhere. More likely, the gun would blow apart. With its bore plugged at the rear, it would be a bomb.

Slow and fast twists affect bullet acceleration and friction in the same ways as these extreme bores but with far less range of variation. In a very slow twist, the radial travel of the bullet is slight, so the net barrel travel of the bullet surface isn't much longer than the distance from the throat to the muzzle.

In a very fast rifling twist, the bearing surface of the bullet travels farther than it would travel in another barrel of the same length with a slower twist. Some of the powder's propulsion energy is therefore absorbed in imparting rotation to the bullet, with that much less energy imparting directly forward motion. Also, this increase in the distance the bearing surface of the bullet must travel means the increased friction resists the bullet movement a bit longer.

This single pressure factor, all by itself, exerts virtually negligible influence on the gas pressure inside the barrel. But if a multitude of other pressure factors combine with this one, *and they all tend to increase the gas pressure*, it can help make the increased pressure dangerous.

Muzzle pressure is much lower than peak chamber pressure, but it comes from powder gas still expanding behind the bullet, still driving it forward. When the bullet exits the muzzle, that surging, thrusting gas spews wildly and freely into the open air, sucks into itself all the oxygen it can absorb, and announces its retirement in the loud report we call muzzle blast.

Chapter 4

You don't need magic.

FORGET CINDERELLA and her fairy godmother. An old gal who could turn mice into horses and a pumpkin into a coach could turn a bushel of spent .22 Long Rifle cases into .600 Nitros in her sleep. But they would all split at midnight. You don't need any magic wand or potion to turn a "parent" or basic case into a custom case.

Modifying or converting one case into another is usually simple. Even the moderately complex conversions consist of simple changes you can make easily. Conversions are complex when you have to do a number of things to each case, then repeat each operation on every case in a good supply. Each step takes time, even if you do it sloppily. Care takes more time, but shortcuts cost more than they save.

Annealing

Omitting or deciding against annealing can be a costly shortcut. You may never have to anneal a case, but if you do, it's easy. A cartridge designer once gave me a short, necked case he'd formed from a longer rifle case. He had not annealed it before he necked it down. The new neck was the upper part of what had been the body of the original cartridge. He had trimmed away the original neck and at least part of the shoulder. He may have loaded and fired it but not more than once; he may have resized it once more. But before he got around to loading it again, the entire neck split in several places and peeled back in curled strips.

I've since used the body of that case as a ferrule for a file handle. I wish I'd saved it to show you what omitting a necessary annealing can cost in terms of case life. He'd put a lot of work into shortening, necking, and reaming expensive cases. In neglecting to anneal them, he'd shortened their useful life to just one loading.

Unfortunately, many who modify cartridge cases both fear and ignore annealing, and others either hurry it too much or overdo it. Short case life, sometimes even canceled case life is the result of both misunderstandings of how important annealing can be and how to anneal the appropriate portions of cases properly. Annealing leaves the neck, the bullet-gripping portion of the case, soft enough to be cold-worked several times — by firing, then by resizing, again and again — but another annealing may become necessary later. Knowing when it's necessary to anneal and how to do it — especially how not to overdo it — marks the expert former of custom cases. It's not so hard to understand, and it's dog-simple to do right, so there's no good reason to do it wrong or omit doing it at all.

Case necks sometimes need to be annealed again, to extend their useful life after a long succession of firings and resizings have work-

hardened them. When case necks start to split, the rest of that batch of cases may need to be annealed again.

Case necks, shoulders, and sometimes their upper bodies often have to be annealed before the case gets drastically modified. One drastic case modification that requires annealing is familiar to most wildcatters — necking the case up or down by more than one caliber step or by more than one die will re-form it — necking the .30-06 down to smaller than .270 or .280 or up to larger than 8mm, for example.

Another drastic modification is re-forming the case body to substantially smaller or larger diameters — swaging a case with a nearly cylindrical body, a shoulder, and a neck down to a long taper, for one example — or blowing a tapered case out to nearly cylindrical.

Remember, cases come annealed enough to accommodate the moderate up-down working of repeated firings and resizings. Below the neck, on the shoulder and upper body, the softness from annealing fades gradually to the hardness range of the lower body and base.

The farther down the case it's necessary to reshape it — up or down, larger or smaller — the more it needs further annealing. Shortening a case so drastically that part of the shoulder or the upper body becomes the new case neck always requires annealing to make the originally harder shoulder or upper body soft enough to be a good case neck. If this shortening of the case also includes necking the old shoulder or upper body radically up or down, annealing that portion of the case becomes even more critical to long case life and good performance.

Extra working of the neck — from either the small but repeated reworking in a lot of firing and shooting or the single drastic renecking to a larger or smaller caliber — hardens the brass and shortens the working life of the case. Annealing gives a tired case a new start, if you don't wait too long to do it.

Neck annealing is often advisable if not necessary whenever you form a case neck to another caliber, as handloaders of most wildcat cartridges know. But we often form cases for one factory cartridge into the shape of another factory cartridge to make a custom case. This re-forming cold-works the brass, making it harder and more brittle. Annealing softens the neck, to offset the cold-working and to retain the resilience of softer brass. If the neck is to stay the same, but the body is to be blown out, annealing usually isn't necessary unless the expansion of the body is radical.

The body, once you've expanded it, doesn't have to be expanded again. But the neck gets worked up and down with every firing and resizing. The expanded body isn't stretched tight over anything, either. But the neck of a loaded case is stretched tight over a bullet. It's under a stress that doesn't affect the hardness of the brass in the shoulder or the body.

You can re-form new brass that's never been sized or loaded, without having to anneal it (the factory annealing is enough), if

- forming it to the new shape doesn't work the neck (or neck and shoulder) drastically
- you're re-forming only the annealed area of the case (the neck, or the neck and shoulder).

Brass that's been loaded and fired again and again, has sat around for years, or has been passed along from one handloader to another probably ought to be annealed before it's re-formed for use as a different cartridge.

Proper annealing seems so ticklish, some handloading experts flatly advise against it — but they're usually not wildcatters, so they get along with factory brass and see annealing only as a means of restoring resiliency to the necks of tired cases. Also, too much of what has long been printed about annealing has sired and reared a family of false ideas that have led handloaders to ruin a lot of good brass by too much or too little annealing. Buying new ready-formed brass isn't always a practical option, even for some well known factory cartridges. It's almost never an option for the fellow who wants to load wildcat or obsolete cartridges.

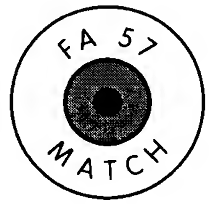
So, despite some otherwise worthy advice, the need for annealing can be inevitable if the brass is to be fit for handloading. And for storage — brass inadequately annealed can split sitting in the box, if it sits around for a while before you call it up to active duty. But overannealed brass is just as thoroughly ruined — this probability is what lies behind the experts' concern about ama-

teurs' annealing their cases.

Overannealing is a double danger. Only the neck, shoulder, and upper body can be safely annealed at all. The rest of the case must retain its original hardness. The head in particular has to be hard — which is why the manufacture of good brass requires enough draws to work-harden the head. The head (especially) can't be safely softened, so the annealing absolutely must be confined to the other end — a process that's ticklish enough with a case as long as the .30-06 and immeasurably trickier with most handgun cases and very short rifle cases.

A manufacturer friend of mine has to import his brass, and there aren't many places he can get the particular brass he needs. He had to reject the entire shipment from one foreign company — annealed from end to end, those cases were as soft in the head as they were in the neck. (I'm inclined to suspect that the fellow who made 'em was, too.)

In days of yore, we riflemen who loaded .30-06 brass (both "straight" and modified every way except with pleats and ruffles) were especially happy if we found a supply of FA Match brass (GI brass made to closer than usual tolerances, at Frankford Arsenal, for GI match loads). In March of 1957, a neighbor came back from Camp Perry with a suitcase or seabag full of once-fired .30-06 cases, headstamped FA 57 MATCH, and gave me several hundred of them. That early in the year, they had to be all from the same batch or lot, too. I gave Elmer Keith one or two hundred for his .333 OKH and his first Africa safari. The rest were supposed to be my lifetime supply for my Iver Henriksen .35 Whelen.



I started loading what I knew were reduced loads, very mild stuff, but got scary signs of excessive pressures. I reduced my loads even more but still got the same high-pressure alarms. Reducing the charge again, to produce little more than a low-smoke, low-recoil belch, did no good either. Iver Henriksen, who'd built the rifle for me, extended the throat a little — no change. Case heads still expanded enough to make the primer pockets loose — some too loose to hold primers at all.

After months of fret and frustration, we found that the case heads were too soft. FA Match brass was the best there was, so we hadn't once thought of it as a possible source of the problem. I don't know how much longer we would've puzzled over the cause of my "excessive pressures" if we hadn't learned from some outside source that early 1957 Frankford Arsenal match brass was flawed. The explanation we got from somewhere was that to streamline case production, Frankford Arsenal had developed a process for making .30-06 brass with one draw fewer than the traditional process.

Omitting that one draw had left the brass soft — the new manufacturing process hadn't work-hardened it enough. Safe enough for one firing, those cases were too soft in the head to be reloaded more than once. The effect of omitting one draw was the same as annealing the head of the case. Any annealing of the head is too much.

But the neck is easy to overanneal, too — get it too hot, which makes it too soft, and it's too weak to grip the bullet as tightly as it should.

There's no good reason to fear annealing. It's easy enough and safe enough for anyone who's willing to be reasonably careful doing it. I shouldn't have to say this, but experience and observation have shown that I have to say **Don't have powder, primers, ammo, lighter fluid, gasoline, or the like anywhere near**. Murphy's Law is right, as far as it goes, that whatever can go wrong will go wrong at the most inopportune time. But Murphy was a pollyanna. Howell's Law is more realistic: whatever can't possibly go wrong will go wrong sooner or later.

If you plan to anneal by the old slap-dash, lick-and-a-promise methods that rely on heating the brass to the right shade of blue, practice first on ruined and junk cases before you try to anneal any you don't want to ruin. Use cases with mouth cracks, enlarged primer pockets, incipient or partial head separations, or Berdan primers if you don't want to load them, or those oddball cases you picked up here and there and never planned to load anyway. Pick up occasional cases for cartridges you don't shoot, when other shooters leave them behind. Clean and polish them so you

can see when the brass changes color with the steep heat you're going to turn on them. Killing the polish with too much heat tells you you've gotten the case too hot.

A few paragraphs later, I'll describe my annealing method — easy, accurate, dependable, consistent, inexpensive, convenient — which completely obsoletes the often-described but inadequate methods of holding brass in molten lead or standing cases in a pan of water, heating them to the right shade of blue, and tipping them over in the water.

Here are the principles of annealing cases:

¤ If you don't get the brass hot enough to change its grain structure, you've wasted your time. If you get it too hot, you've ruined the case. The range of temperatures between these two points is narrow, so you need close control of heat and an accurate way to tell when it's right.

¤ A large flame or a wide spread heats too much area too slowly. A single small flame with a sharp tip is necessary, to direct and confine the heat to the area to be annealed.

¤ A hot, hot flame gets the neck end up to the right heat quickly enough to keep the base end from getting too hot. A "hot enough" flame isn't hot enough. "Too hot" is right.

¤ A heat sink (heat absorber) on the head helps protect this critical area from heat that roams downward while the neck heats up to the annealing temperature.

¤ A comfortable, convenient case holder must protect your flesh from heat and allow you to quench the cases quickly when they reach annealing temperature, and to replace them easily with the next case to be annealed.

¤ The neck end of the case must be annealed evenly all around, so it must turn in the flame (preferably) or be surrounded by a ring of flames directed inward.

¤ When the neck end of the case gets hot enough for the grain structure of the brass to change, the case has to be cooled down all the way, at once.

I prefer to anneal cases before I modify their forms, especially if their new shape is going to be drastically different from the original. Some handloaders neck their cases up or down, or force the shoulder back, then anneal them before they load them. The more I'm going to change them, the more I like to anneal them before I reshape them. If I'm only slightly necking them up or down, without changing the shoulder, I can probably anneal either before or after I cold-work the brass (which does harden it a bit).

Quick, uniform, consistent application of high heat is the key to good annealing. There'd better not be a live primer in the primer pocket. You just don't know how hard you can jump or how wide your eyes can pop until you've cooked off a rifle primer in a small room. A friend of mine who did — and knows — and isn't going to forget anytime soon — is emphatic about this. If the base of the case is clear, it becomes a launching pad for that rocketing primer, which you may not see again unless you ask the doctor to save it for you after he digs it out of your eye.

There's also a good reason for making sure there's not even a spent primer in the case you're heating. Annealing comprises not just one but two main steps — heating and quenching. A spent primer blocks the flow of air or water through the primer vent when you drop a heated case into the quench water. I'm not sure this does any harm, but I like to have the primer vent free, just in case the free flow of air or water through it helps make the quenching neat and consistent.

Also, if there's a "spent" primer in the case, it might turn out to be a live one when I least expect or can take much excitement.

When the brass around the mouth reaches a temperature of about 660° to 665° Fahrenheit (about 350° Celsius, which equals 662° Fahrenheit), its surface becomes light blue — and this is as hot as you want to let it get. If you let the color run too far toward the other end of the case, you can ruin the head by making it too soft. If you let the color on the neck go beyond light blue, and the shine disappears, you're on the thin edge of ruining the case, and you may already have gone too far.

If you let the case get red, it's a goner. Ignore published "expert" (but totally wrong) advice that tells you to heat it red-hot. Squeeze the mouth with pliers, and you'll see how soft it is. Remember two things: shine and light blue. Anything further is too much — and even these,

too far below the shoulder, mean too much heat.

But depending on getting the color just right is too loose and iffy to suit me. I prefer and recommend relying on something more dependable than personal color perception. The most reliable case thermometer I know is a 650° or 660° F temperature-sensitive crayon (called a "temp stick," usually). More on this in a bit.

Some writers recommend using a small gas torch. Others like a pot of bullet metal to heat case necks, but the hot, small flame of a torch is the only heat source you can rely on to give you the quick, local heat you need for selectively annealing the neck — and maybe the shoulder and upper body — without heat-softening the base. The high heat is not just better than the lower heat — it's the only practical heat. The torch also offers one critical advantage over the pot: lead puts out poisonous fumes at 900° Fahrenheit and hotter, and this isn't hot enough to anneal cases properly.

High heat brings the neck and shoulder up to annealing temperature quickly, while the base end is still safely cooler; lower heat lets the base end get too hot while the neck and shoulder are getting just hot enough. Therefore, safe neck annealing takes high heat and a surprisingly short time — and he who dawdles over it ruins cases. High heat is necessary to protect the base, but its rapid heating of the neck and shoulder risks overannealing the neck. You can't depend on feeling the heat at one end to tell you when it's right at the other end. When you feel uncomfortable heat transmitted to your thumb and forefinger through the brass, you may have already ruined the other end of that case. Some people's fingertips can tolerate a lot of heat, others little or none, so your wince-and-swear threshold is a poor way to tell when the case is adequately annealed but not overdone.

Temperature-sensing crayons allow close temperature control. Any well stocked welding supplier has them or knows where to get them. McMaster-Carr stocks two kinds, and I hope a few handloader suppliers like Huntington's will stock them if there's enough demand for them (see Chapter 7 for addresses). The mark made by one kind of crayon melts at the rated temperature, plus or minus one degree. The other kind leaves a yellow mark that changes to red-brown at the rated temperature and tolerance.

The 650° F crayon, which melts at about 10° to 15° F below annealing temperature, is Number 3261K449 in my old McMaster-Carr catalog, at a nominal price of $7.80 (I say *nominal* price because McMaster-Carr charges the price that's current when you order — sometimes less, sometimes more, usually close). Be sure to specify "crayon" when you order — McMaster-Carr also sells 650° F temperature-sensing pellets under the same catalog number. These pellets are for other applications and aren't adaptable to case annealing. The 660° F crayon changes color at approximately the correct annealing temperature (within two degrees or so). Its catalog number is 5960K71, its nominal price $6.20 in my old catalog. Both crayons come with aluminum pocket holders.

Which crayon is better? For annealing only a short area such as just the neck and not much lower on the case, the 660° color-change crayon is probably better, technically (for a mark at the lower edge of the area to be annealed). When the color changes a bit lower down, the upper neck should be just about the right amount hotter. Annealing a longer area — neck, shoulder, and upper body, say — means there's a wider range of temperatures between the mouth of the case and the lower edge of the annealing area. The 650° melting crayon allows a range of about 10° to 15° Fahrenheit. You could use this crayon to mark the lower edge of the area to be annealed, or the other crayon to mark the upper portion of the annealing area.

If I were you, I'd get one of each type of crayon and evolve my own system with whichever crayon I liked better. You may well find one type of crayon better for annealing some cases and the other better for other cases. And one pair of eyes may see one crayon mark change color more easily than they see the other mark melt and run, while the latter mark may be easier for another pair of eyes to see. Try both. There may come a day when the type you prefer is worn out, lost, or not available soon enough for some important annealing you want to do *right now*.

The simple, convenient annealing system I favor uses the threaded locking stud and appro-

priate shell holder from a Lee case trimmer to grip the base of the case, both for twirling the case in the tip of the flame and for absorbing any heat that may reach the base of the case while I'm annealing the other end. I like to have at least a handle on the shaft of the Lee case trimmer's locking stud, but no handle is really necessary — just a nice touch.

The handiest thing I've found is an old-fashioned hand drill. My son got a cheap and chintzy one at a swap meet for a quarter, and it isn't worth even that much for drilling. But it's just the ticket for twirling a case in the tip of a flame, so I guess it's worth more than a quarter after all.

Or, if you prefer a high-tech version — at the 1994 SHOT show, Ken Oehler suggested chucking the locking stud in an electric screwdriver. I'd thought of chucking it in an electric drill, but I had abandoned that idea, because the faster speed of the drill would most likely make the crayon mark hard or impossible to see well enough. Ken Oehler's idea of using an electric screwdriver is worth looking into. I've never used an electric screwdriver, but the idea seems good to me — if I ever want anything fancier than the old hand drill. (Ken often comes up with good ideas. He makes the Oehler — pronounced like *Taylor* without the *T* — chronographs and personal ballistics system.)

I thread the shell holder onto the stud, insert a crayon-marked case in the shell holder, tighten the stud into the shell holder to grip the rim of the case (it doesn't have to be tight), and twirl the neck of the case to let the tip of the flame heat the neck all the way around, at or just above the middle of the neck (or where the eventual neck will be).

An alternative method is to thread a bronze-bristle bore-scrubber brush of the same caliber as the case neck (or slightly larger) into a section of a jointed cleaning rod or directly into a wood (preferably) or plastic handle — or best of all, chuck it in a hand drill or electric screwdriver. If you don't have a hand drill or electric screwdriver, a swiveling handle and a short pistol-length section of cleaning rod is just about perfect, especially if the handle is plastic and therefore has to be protected from the heat.

Thrust the brush into the neck of the case you've polished and marked with the appropriate temp-sensor crayon. When the polished brass is the right shade of blue, the crayon mark will melt or change color in response to the heat. Shove the case immediately into cold water, pull the case off the brush, and set it aside to dry. Or drop it into the water if it still feels hot.

Don't use the mouth-support method (the brush) if you can set yourself up to use the base-support method (the Lee shell holder), especially if you're annealing a long section of a short case. Two extreme cases leap to mind — annealing the .32 Auto case before forming it to the .22 Flea, and annealing the .45 Auto case before forming it to Bo Clerke's superb .38-.45 Auto. For either of these and for a host of others less critical, the only safely workable method is one that absorbs as much as possible of the heat that reaches the base before the annealing area gets hot enough. Try annealing either of these by holding it in the heat with your thumb and forefinger, and you're sure to wind up with some combination of a hot but unannealed neck, a heat-softened base, and finger blisters.

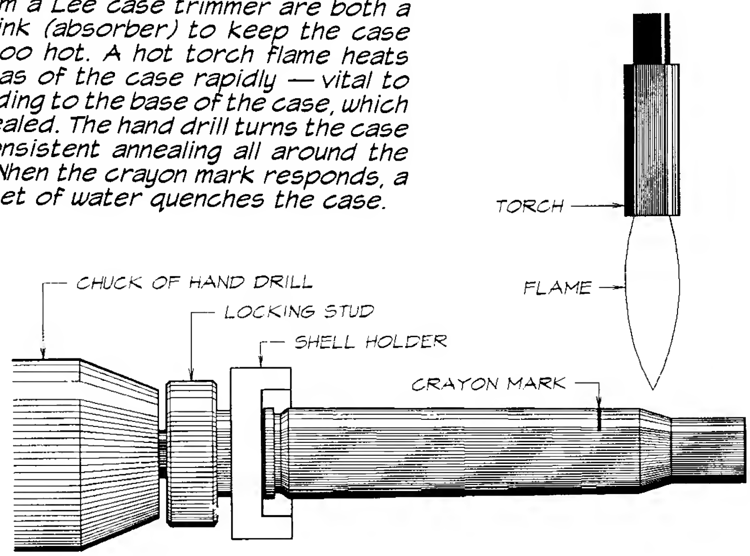
If you use the brush and have only a plastic handle for it, be sure to cool the brush thoroughly with each case you quench, or heat buildup will melt the plastic. The older RCBS wooden handle was far superior to the prettier plastic handles now current. (Lyman still sells wooden handles, I think.) If you anneal a lot of cases, especially if you anneal them far below the shoulder, get a wooden file handle from Brownell's and adapt it to hold your bronze brushes.

Use a good-sized container for your quench water. A bunch of hot cases, even little ones, can heat up a bucketful of tap water faster than you might think it could. If you plan to load them soon, dry them thoroughly with a jet of compressed air. Make sure no droplet of moisture remains in the primer vent. The absence of a primer is obviously an asset here too.

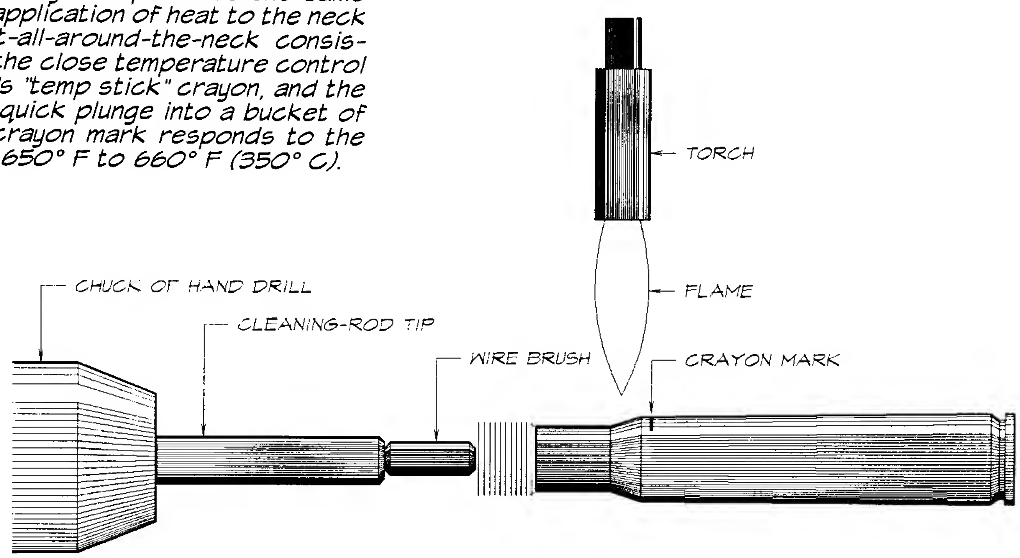
Forming Cases

There's no universally best way to re-form a parent case into a custom case. Once you choose a custom cartridge, and the case you want to make it from, the way to form it may offer you

The crayon mark from a 650° F or 660° F temperature-sensitive crayon melts or changes color when the case neck and shoulder reach the rated heat (within 1° F) for close temperature control. The locking stud and shell holder from a Lee case trimmer are both a chuck and a heat sink (absorber) to keep the case head from getting too hot. A hot torch flame heats the appropriate areas of the case rapidly — vital to preclude heat spreading to the base of the case, which MUST NEVER be annealed. The hand drill turns the case evenly to ensure consistent annealing all around the neck and shoulder. When the crayon mark responds, a quick dunk in a bucket of water quenches the case.



This less satisfactory alternate annealing system lacks the heat sink, so the risk of overheating the case head is much greater. This system is safe only for annealing the necks and shoulders of long cases. Except for these shortcomings, this system provides the same control over the rapid application of heat to the neck and shoulder, the heat-all-around-the-neck consistency of the hand drill, the close temperature control provided by the welder's "temp stick" crayon, and the prompt quenching of a quick plunge into a bucket of water as soon as the crayon mark responds to the proper temperature — 650° F to 660° F (350° C).



no choice at all. Or you may have to choose whether it's better or more desirable to re-form the parent case in the appropriate form die or sizer die, or to fire-form it in the chamber of the gun. If you have this much say in the choice, remember that even the best form or sizer die is a substitute for the chamber and an approximation of it. (Of course, you assume it's a very close approximation.)

The most common and familiar way to alter the shape of a case is to run it into a die (or two or three dies). It's the only method most handloaders use, because it's the only way most handloaders know. And of course it's the best way for the most common case-forming operations. It's the only way you can make some changes. But it isn't always the best way — and not the way at all for some operations.

Parent cases often re-form to the new custom-cartridge dimensions with one insertion into the sizer die for the new cartridge. Other custom cartridges require more than just one simple resizing. In a few very well equipped handloaders' shops, successions of intermediate sizer dies (usually used to resize other cartridges with intermediate dimensions) can adequately massage parent cases into the new shapes. But intermediate dies generally offer an attractive delusion that exacts its special penalties by ruining cases. Most handloaders don't have the variety of dies they need to select the right intermediate sizer dies, anyway.

When a new case shape requires more than one re-forming step to convert the parent case to the custom case, a special set of custom forming dies is far more dependable and efficient. Some of these sets also include trim and neck-ream dies. The extra cost of these dies fades away before the extra assurance, reliability, and satisfaction they ensure. They're also generally easier to use than the slap-dash case-forming methods they replace.

Since 1953, I've tried more ways of modifying brass than I can remember (some good, others not), and I've read and heard of others that are obviously not good. I tried only whatever I thought would do what I wanted done, preferably well. I adopted only the ways I liked. I tried a variety of methods to figure out my own best ways, of course, not with the idea of passing the word along to you now. So my slant here has to be something less than eclectic, catholic, or encyclopedic. I recommend only what has worked well for me. And I recommend most enthusiastically what I think is the better or best way of doing something, not what's easiest or most often discussed in print here and there.

My general rules of thumb are simple:

¤ Neck and re-form cases *down* in the appropriate dies, small step by small step.
¤ Fire-form with a light charge and the case full of inert filler (to the mouth, with **no bullet**) to neck and expand cases *up*.

When you use the appropriate dies and the right parent cases, you're not likely to have any problem making those cases smaller in the right places — unless you are

¤ not annealing when and how you should, or
¤ resizing in only one die when you should use two or more.

But even with the appropriate dies, expanders, and parent cases, making those cases larger in the right places is sure to give you problems — if, like me, you want all your cases to be consistent and concentric.

To neck .30-06 brass out to .35 Whelen and .348 Winchester brass up to .450 Alaskan, for example, I've used all the published methods of mechanical forming, and I have gone further, experimenting with ways of using the recommended tapered expanders and successions of expanders. Some of these techniques worked better than others, but I'm not going to describe any of them here — because none of them was consistent enough.

Every *mechanical* neck-out technique I've tried failed to neck cases out consistently and concentrically. I've had .348 Winchester cases, for example, neck out so far off-center, the neck-and-shoulder line on one side didn't change at all, while all the expansion from .348 to .450 swelled the mouth out *beyond the body line* on the opposite side.

The more common off-center forming left a little shoulder on one side, more shoulder on the opposite side, and a lopsided mouth with a permanent sneer. The old-time wildcatters of the Thirties and Forties (including some of the most

prominent pioneer wildcatters) didn't do any better — their cases sneered as nastily as mine did. Nothing they or I ever did could wipe those sneers off those lopsided mouths — except, of course, trimming them back drastically. Even drastic trimming left the necks off-center.

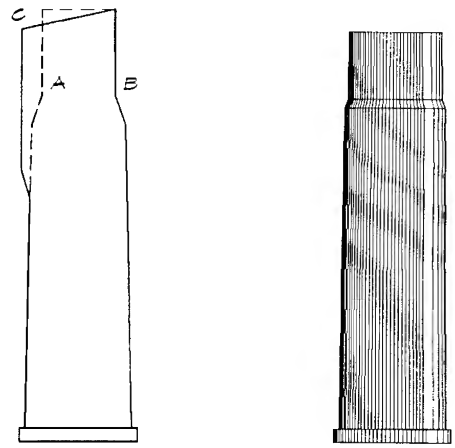
The older fellows settled for what they got when they necked cases out this way, and several opined that I was being overly picky when I persisted in looking for a way to neck cases out concentrically and evenly. I found it, too. Fire-form with pistol primers and powder (even in a huge rifle case), a light over-powder wad, a caseful of inert filler, **and no bullet**. This method is no cure-all, of course. No single case-forming technique is. But it's *the* way to make any part of the case bigger than it is.

When the brass is softer or thinner on one side, it swells outward in that direction first, until the chamber wall stops it and forces all further expansion to the other side. Dies don't support cases fully while expanders swell the necks. The necessary clearances that allow the case and the expander to occupy the die at the same time, without getting stuck too tight for nondestructive removal, make it impossible for the die to restrict expansion as dependably and accurately as the chamber does.

Some re-formings don't offer you any alternative method. You can't fire-form a case that won't enter the chamber. You can't move a case shoulder forward by running the case into a form or sizer die. The decision whether to re-form the case by pushing it into a form or sizer die or by fire-forming it in the chamber may be out of your reach because only one method is possible.

Or you may have to use first one method to re-form one part of the case, then the other method to re-form the rest of the case. A common example is the combination of necking a case down and blowing its shoulder out to a larger diameter. You'd neck it down in a sizer die, a form die, or a series of form dies, then fire-form it to expand the body.

Most shooters use the die or dies first, then load the partially formed case with a more or less normal powder charge and a bullet, and finally fire the bullet into a safe backstop. Prudent fire-formers sometimes have to repeat these steps



A special tapered expander, made specifically to neck .348 Winchester brass out to form it into .450 Alaskan, formed necks off-center for me. It expanded the neck on one side (A) out beyond the body (C) without affecting the opposite side of the neck (B) at all. But every case I fire-formed with inert filler (right) came out perfectly formed.

because their reduced first loads don't fully expand the body and shoulder against the walls of the chamber.

If you enlarge the neck of a rifle case with die and expander, then load that case with a rifle primer, a light or moderate charge of rifle powder, and a bullet, the powder gas (under pressure) inflates the case like a balloon. If you're fire-forming to reduce the body taper and to force the shoulder out to a steeper angle, and you haven't used a large-enough powder charge, the chamber pressure is too low to force the body and shoulder of the case out hard against the steel walls of the chamber. The shoulder forms only partially and leaves a long curve at its junction with the body. You have to fire-form it again, to force it out to the desired new dimensions.

My first loads for fire-forming .30-06 brass to nearly cylindrical .30-06 basic brass were too light. I had expanded the neck out to its full diameter, but the gas pressure didn't force the body out to that diameter. Those cases looked ridiculous. The pressure of the first fire-forming load wasn't high enough to force the thicker and harder body walls out to the chamber wall. So the case was the same diameter at the base and the mouth, but smaller in diameter along the still tapered body.

Inert fillers are still solids after the powder has become gas. Under the propelling force of

the powder gas, they swage the stiffer portions of the case outward. They also fill the case so a smaller powder charge can generate enough gas pressure to force the case out hard against the inside of the chamber.

Fire-forming with inert filler is even superior to hydraulic case-forming, which is a superb way to make parts of cases bigger. But hydraulic forming is messy and inconvenient. Some hydraulic-forming setups require that cases first be necked out mechanically. A hydraulic-forming setup "chambers" the unmodified or partially modified case in a facsimile of the chamber and uses a liquid at momentarily high pressure to force the case against the walls of the chamber.

I've formed cases under hydraulic pressures high enough to imprint the case with the tool marks on the inside walls of the die. The fellow who made my hydraulic case-forming die drilled a tiny hole though one wall to let trapped air escape (and many's the time I've cussed him when it leaked water out!), and that wee hole left tiny warts on the sides of my cases. This little bump did no harm — the sizer die ironed it flat, anyway. I mention it only because it was an excellent sign that my hydraulic case-forming pressures had been right up there with pretty stout chamber pressures.

I keep this hydraulic rig for its history. The same year James V Howe necked the .30-06 to .35 and named his wildcat in honor of Colonel Townsend Whelen, a California gunsmith came up with almost exactly the same cartridge. The Californian's design was more ambitious — he moved the shoulder forward, steepened it, and expanded it. I don't know what he called his forerunner of the .35 Brown-Whelen. He reformed .30-06 brass in this hydraulic case former, which he'd made from a Ford axle. Iver Henriksen acquired his dies and punches years later, but he had forgotten the man's name and details of his .35-06 wildcat by the time he gave me the Californian's old dies and punches for making cases for it.

Using that old hydraulic case former and the unique device for necking the .30-06 to .35 fascinated me. I used them (and variations on them) for years and still have them. But I never use them anymore. I designed a better hydraulic former and made a prototype. Tests showed one easily correctable minor flaw, but I haven't corrected it with a new prototype.

Fire-Forming without Bullets

For twenty years or so, I've preferred to expand the necks and bodies of rifle cases by fire-forming them with an inert filler (**and no bullet**, remember) whenever the before and after dimensions of the case make fire-forming an option. Fire-forming, when it's a workable alternative, turns out to be the best way and sometimes the only way to form certain cases. Fire-forming with inert filler is less expensive than fire-forming with a bullet driven by a moderate to full powder charge.

Inert-filler loads fire-form both the body and the neck of the case at the same time. The neck expands on-axis to fit the chamber. It's neither off-center nor lopsided, both of which are common flaws in cases necked-up with expanders. I hate those supercilious, sneering cases.

Prime your cases with *pistol* primers — to keep pressures from going through the roof. **Do not use rifle primers**. In a typical long, necked rifle cartridge, the powder charge for a normal load is substantially larger — obviously more expensive — and the bullet adds another cost. But a fire-forming charge of Bullseye or similarly fast-burning pistol or shotgun powder is always a small charge.

I don't have records of how much Bullseye I've used to fire-form any of the cases I've formed wholly or partially by this method, and I don't trust my rickety memory on something this critical. I know of no published charge data — except the late George Nonte's advice in his book on cartridge conversions:

"Ten grains of Bullseye will do a good job of forming the .219 Zipper improved cases. Sixteen grains of the same powder does an equally good job in blowing out standard .30-06 cases to size and shape for the .35 Whelen Improved ... start with a small charge of Bullseye that will fill about ten percent of the volume of the unformed case. Work up from this until a charge is reached that gives a cleanly formed case. Watch the primers closely for any signs of excessive pressures. It is entirely possible to develop a danger-

ous pressure with this type of load. Half grain increases are plenty until adequate expansion is achieved."

To calculate Nonte's recommended starter load for fire-forming your parent case, seat a *fired* primer (as a safeguard) in an empty, unformed case, then fill that case full of Bullseye — level to the mouth. Carefully pour all the Bullseye into the pan of your powder scale and weigh it. Divide the weight of a caseful of powder by 10 to determine the "small charge of Bullseye that will fill about ten percent of the volume of the unformed case."

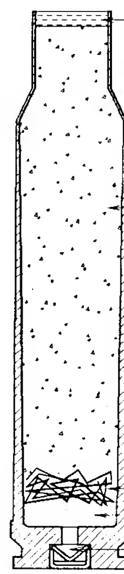
Move the decimal one place to your *left*. For example, if your caseful of Bullseye weighs, say, 108.7 grains, the new place for the decimal is between the 0 and the 8, to give you the new figure of 10.87 grains. Rounded off, 10.9 or even 11 grains is probably close enough. Load only one or two cases with the starter load.

With a dowel that slips easily into the neck of the unformed case, lightly tamp a wadded-up quarter of a sheet of toilet paper onto the powder. Then fill the case to the mouth with an inexpensive granular, nonabrasive, inert filler. Instant Ralston was the cheapest thing on the grocer's shelf the last time I bought a box of inert filler for forming cases. Others have used Cream of Wheat and cornmeal.

Some of the earliest users of this method filled their cases with water-pump grease — a heavy, coarse, thick, practically dry grease with a little oil in a lot of soap carrier. Fine birdseed may be all right, too. *But not flour or anything else so fine*, which is almost certain to pack into an immovable wad, sooner or later, and give you more grief than you can handle. Sawdust? I don't know. May work. But I'm inclined to stick with what I know is safe and doesn't scour the barrel — Instant Ralston, cornmeal, Cream of Wheat, or the like.

To keep the filler from spilling when you handle and move your filled case, press a small blob of bullet lubricant over the mouth of the case. I carve a slice off the end of a stick of bullet lube, roll it into a wad between my palms, flatten the wad, push it down onto the mouth of the case, and wipe away the "trimmings" left over after the case mouth "cookie cutters" out a disc of the right diameter to plug the mouth and hold the filler in place. I've successfully handled boxes of fire-forming loads, without the mouth wad and without spilling any filler — once hauled a batch out into the desert to fire them. But the mouth wad is definitely preferable.

Insert the case into the chamber by hand, not from the magazine. Slip the rim under the extractor claw if you're fire-forming in a '98 Mauser. I've fire-formed a slew of cases in a barreled action — holding the barrel vertical in



Fire-forming loads with inert fillers NEVER include bullets — that's one of the economies of this method. The small powder charge also trims costs. Inert filler costs less than a full charge of powder, let alone a full charge plus a bullet. Yet this case-forming method expands case bodies, shoulders, and necks consistently and concentrically.

one hand and the action in the other. The immediately high rise in chamber pressure blows the plug of inert filler forward, and it swages the case out against the sides of the chamber, when the forming charge is adequate. The loose filler is an ineffective plug. It lets some of the powder gas escape through it, apparently, so the barrel pressure dissipates fast.

Fire-forming with inert filler is safe, since there's no bullet to go anywhere it shouldn't. If you take care of the noise somehow, or if the noise is no problem, you can fire-form with inert filler just about anywhere, including your attic, basement, garage, or back yard. Nothing danger-

ous spews forth. Nonte said (and I never tested his word on this!) his fire-forming loads didn't even endanger his wife's laundry nearby:

"The resulting load can be fired anywhere that the noise of discharge will not get you into trouble. Many have been fired in the writer's basement in complete safety. The only thing that issues from the muzzle is the corn meal and a few shreds of paper. The energy of the meal is dissipated in a few inches; at a distance of one yard, it will not even damage a sheet hanging from the basement clothesline."

If the starter load is too weak to fire-form the case all the way out against the chamber wall, load another case or two with a slightly larger powder charge — no more than half a grain more — and try it if the starter load hasn't given you any warning of dangerously high pressure.

There is noise. If it's a nuisance or causes problems, a buried (or heavily swaddled) oil drum, with a pipe threaded into the larger bunghole and long enough to reach above the ground, muffles the noise of a fire-forming load if you fire into the drum with the muzzle well inside the upper end of the pipe. Be sure to remove the smaller bung as well, then thread a vent pipe into the smaller bung hole, and arrange this vent pipe (or this set of pipes) to let the powder gas seep out of the drum. Otherwise, you could get a surprise when you unscrew the breech cap to take that beautifully formed case out of the chamber.

You can fire an awful lot of Instant Ralston or Cream of Wheat into the ground before you have to dig up the drum and dump out the inert filler you've collected there. I'm thinking of putting my drum in the attic of my shop, with the pipe jutting down just far enough to accept the gunbarrel, not low enough to plow a groove in my scalp when I walk under it. If the noise still bothers me or the neighbors, I may encase the drum in a crate of sand or some other sound-muting material.

More of a problem with inert-filler fire-forming is — with some guns — headspacing the parent case. I've blown .30-06 brass nearly cylindrical, fire-forming it to .444 Marlin Rimless brass, with the rim of the .30-06 case under the extractor claw of a Mauser bolt as I eased the case into the chamber. Spring-loaded ejectors on other actions may make this difficult or even impossible. Rimmed and belted cases, of course, headspace on case features behind the portions of the cases getting reshaped. If the shoulder of a rimless case forms a headspace resistance to drive-in, even though the diameter of the shoulder is going to increase with the fire-forming, there's no problem.

A problem arises when you want to fire-form a rimless case to blow the shoulder forward but the ejector on your gun won't let the extractor hold the head of the case against the face of the bolt. This is where my special fire-forming jig comes in — a special washer, cut to form a C, fits into the extractor groove and extends outward to give the case a temporary "rim" to headspace it in the chamber of the fire-forming jig. The jig is something you can set up easily with the drum to catch the filler and kill the sound, so its convenient use indoors more than makes up for the extra step it adds to the process of fire-forming.

Now back to George Nonte's comments:

"There is one job for which filler loads are admirably suited. With them you can produce your own cylindrical cases from any caliber that is available. ... cylindrical cases ... are excellent cases from which to form all sorts of calibres ... Once fired cases are obtainable for little or nothing, and they can be converted to cylindrical shape by fire forming.

"To do this with rimless cases of .30/06 head size, get an old 98 Mauser military rifle with a shot out bore. Bore the barrel out as shown in plate 54 after having sawed it off to a more convenient length. The chamber must then be reamed out with a taper reamer until the shoulder of a .30/06 case is a crush fit as it contacts the chamber walls. This interference fit insures that the '06 case will be well supported against the firing pin blow....

"Cases to be blown all the way out in the above fashion are loaded just as other filler loads after the proper charge has been determined. This can only be done by starting low and working up until the desired expansion is achieved.

"The choice of the 98 Mauser for the above work is based upon its adaptability to rapid changing of barrels. Additional barrels in all sorts of calibers can be picked up for a song from shops that specialize in rebarreling. So long as the chambers are good, such barrels can be used for fire forming, no matter how rough the bore may be. Thousands of shot-out Mauser barrels suitable for this are floating around the country. Remove the barrel prepared for cylindrical cases and polish up the threads on other barrels to be used for fire forming until they can be turned in by hand to butt up against the ring inside the receiver. File or mill a pair of parallel flats on these barrels near the breech and it will be an easy matter to insert or remove them at any time with the aid of an eight-inch crescent wrench. With one action and a rack full of assorted barrels, you are ready to fire form as many calibers as there are barrels.

"It will be more convenient if the barrels are cut off to the minimum legal length of 16". Changing barrels will also be simplified by cutting off the forestock of the Mauser just in front of the receiver ring. This will allow free access with the wrench while the action is still in the stock. Empty cases and filler loads do not feed well enough from the magazine to come up under the extractor properly; so it may be best to remove the extractor entirely. This will necessitate the use of a length of cleaning rod with which to punch out the formed cases after firing.

"One can also gather up an armful of issue 8mm barrels for the 98 and have them rechambered for the numerous 8mm calibers to provide still more versatility for this case-forming gun. The standard military 8mm barrel can be rechambered for the 8x60mm, 8x68S, 8x50R and numerous others. Headspace of cases formed in this manner may not always be exactly right, due to chamber variations; so they should always be sized full length before further use in other arms.

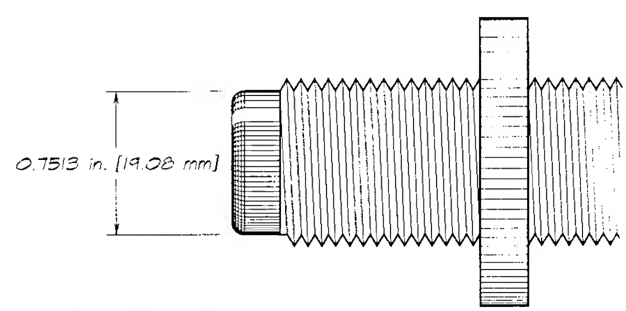
"The foregoing has been applicable primarily to rimless cases. The same can be done with the rimmed variety. Just select a reasonably good single-shot action and proceed in the same manner. The Winchester high-wall action is probably the best bet for this due to the large number of calibers in which barrels for it may be found. The Remington military rolling block is easier to pick up and relatively easy to rebarrel, so it is also a good choice....

"These case-forming guns are a real money saver when you are called on to produce cases for a gun not readily available. Just take the right barrel down off the rack and you're in business. No need for the customer to send in his gun or to pay those not-inconsiderable shipping charges that eat so deeply into the pocket book these days."

In *The Handloader's Manual of Cartridge Conversions*, John Donnelly shows how he adapted a Huntington Compac portable handloading press to fire-form cases with inert-filler loads. Standard 7/8-14-thread loading dies may surround the case with enough good steel to fire-form small- and medium-diameter cases safely, but I'm more comfortable with my fire-forming jig — made with plenty of good steel and made large enough.

My jig for fire-forming rimless cases includes a special headspacing washer, a near-clone of the washers that adapt inertia bullet-pullers for pulling bullets from rimless and belted magnum cases.

I'm still refining my fire-forming jig, so my drawing shows no dimensions. It isn't to scale, either — so it's also useless for scaling-off dimensions for your use. "Silver and gold have I none;" like Peter at the temple gate, " but such as I have give I thee." There's no standard set of



I'm not sure that fire-forming a case in a forming or sizing die is safe, so I don't try it or advise it.

dimensions, because most of its dimensions are not critical. Your version doesn't have to match mine except in general concept — and not even the concept is graven in stone. So my drawing is only a schematic drawing of my jig. It isn't drawn to scale except for the .30-06 case and the cylindrical chamber for fire-forming any .30-06-base case to make basic brass.

The chamber for fire-forming basic brass doesn't have to be cylindrical. A long, straight taper is better, if the new mouth diameter of the fire-formed basic case will be large enough to accommodate all the necks of the cases you expect to form, and if you can find a taper reamer with the right diameters and appropriate taper. Some tapered forming chambers can even provide their own unique headspace system — you force the case into the tapered chamber just far enough to allow screwing the breech cap onto the breech end. McMaster-Carr (Chapter 7) sells taper reamers in a variety of sizes.

The drawing shows my jig set up for use with a fluff trap to catch the filler. If you prefer to run a large pipe through a shop wall into the outside air, into a yard drain, or into a vented drum outside, the jig would be the same, but you'll want to adapt it to a pipe cap or reducer where my drawing shows a bung.

Or you may prefer to trap the inert filler instead of blowing it outside. To make the fluff trap, remove both bungs from a fifty-five-gallon steel drum. The fire-forming jig I'm going to describe will take take the place of the larger bung. But first, clean out the drum so it no longer includes any residue of corrosive or explosive substance it may have contained (road salt, for example, or gasoline). Thread a vent pipe into the smaller bung hole, and arrange this vent pipe (or set of pipes) to vent the powder gas out of the drum. Or if the noise of fire-forming isn't going to be a problem, punch several holes in whichever side of the drum will be uppermost when you use it as a fire-forming fluff trap.

Establish jig dimensions that will be more than adequate for the largest case you may ever want to form, then make the parts I've shown in my drawing. If you can't make them yourself, any capable machinist can turn them out for you. I wouldn't use steel bar less than an inch in diameter to make chamber cylinders for medium or moderate-size cases, and I prefer bigger stock for bigger cases. Also, being a confirmed 'fraidy cat, I want at least a quarter inch net thickness in the threaded forward section of the breech cap, and bigger is better.

The rear of the breech cap must be long enough to leave a healthfully thick wall ahead of the larger section of the firing pin, and enough length for a long guide hole for the rear section of the firing pin. When the firing pin is all the way forward, its tip should show not more than 0.050 inch clear. The chamber pressures of inert-filler loads are mild, but I like insurance against both Murphy's and Howell's Laws. Whatever can go wrong, and whatever can't possibly go wrong, *will*, sooner or later.

Three of these parts are system basics or standards — you'll use the breech assembly, bung, and lock nut with any chamber cylinder you make to fit them. When you make these (or have someone make them), include a number of turned and threaded, pilot-drilled blank chamber cylinders you can later ream out for other specific custom chambers.

One option is to simply bore or ream a few blank chamber cylinders to fire-form cylindrical cases you can later form into specific cases with your forming or loading dies. Pilot drill, then bore, and finally ream cylindrical or slightly tapered bores, with the breech end of each bore the inside diameter of the basic minimum chamber. One chamber cylinder for the .30-06 will enable you to fire-form .30-06 brass to cylindrical basic brass, for example. Bore another chamber cylinder for the H&H Magnum base, another for the .223, others for the .30-30, .30-40, .348, and so on — and these few chamber cylinders will set you up to fire-form basic cases for hundreds of other cartridges.

To keep the chamber cylinder from being considered a barrel, make it no longer than the parent case you're going to fire-form — or if it has to be longer to accommodate a short case to the system, counterbore the forward portion of the chamber cylinder appreciably larger than the chamber diameter. This dimension or modification of the chamber cylinder is simply a legal precaution — to avoid leaving any "bore" or

"gunbarrel" ahead of the chamber. It has no ballistic significance.

Make the bung to fit one of the bungholes in the top of the barrel. Thread its outside diameter for the drum's bunghole. Thread its inside diameter to accommodate any of your chamber cylinders. If the thread on your chamber cylinders doesn't fit any standard-thread lock nut, you'll have to make one.

Thread the breech cap to screw easily onto the breech end of the chamber cylinder, with the same thread used all along the chamber cylinder and inside the lock nut and bung. The length and outside diameter of the breech cap can be any dimensions that guarantee you enough steel for confidence. The breech cap, its insert, and the firing pin and spring inside the insert, all work with any chamber cylinder you use with them — if you've planned your dimensions well.

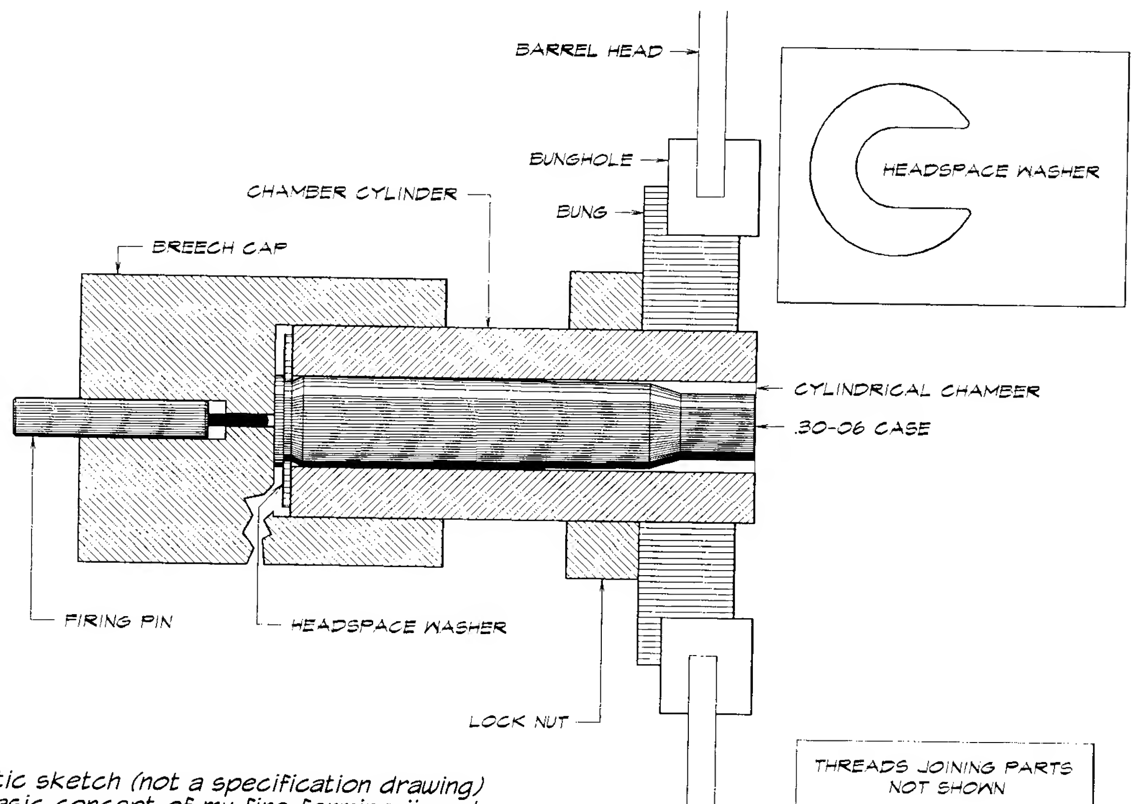
The headspace washer is the thickness of the extractor groove, or it can be thicker if you countersink the front surface to accommodate the chamfer forward of the extractor groove in the case. You won't need any headspace washer for rimmed, semirimmed, or belted brass — just for rimless and rebated-rim brass.

The outside diameter of this special headspace washer isn't critical — it just has to be large enough for strength and small enough to fit loosely inside the breech cap.

My drawing doesn't show any hammer — you can fire the fire-forming rounds in this jig with a moderate whack on the firing pin with a small, light hammer or just a hammer handle.

Turning and Reaming Case Necks

If you're lucky, you'll never have to do anything to the necks of your cases (once you've re-formed them) except run them into a sizer die to make them tight enough to hold the bullets you're going to stuff into them. Most custom cartridges, if you form them right in the first



This schematic sketch (not a specification drawing) shows the basic concept of my fire-forming jig set up in the larger bung hole of a 50-gallon steel drum, which serves as a noise mute and a fluff trap. Only the .30-06 case, cylindrical chamber, and headspace washer are to scale. The chamber can just as well be reamed with a taper reamer, to form basic brass.

place, don't need their necks manicured with either a turning tool — which shaves excess brass off the outside of the neck — or a reaming die and reamer, which shaves excess brass off the inside of the neck.

Both turning and reaming may be necessary to fine-tune some cases, but neither turning nor reaming does exactly what the other does. Both are easy to overdo, but turning can get out of hand quicker and easier than reaming. (The only sensible way to ream inside necks uses a die to hold the case and guide the reamer, which of course must be of the appropriate diameter.)

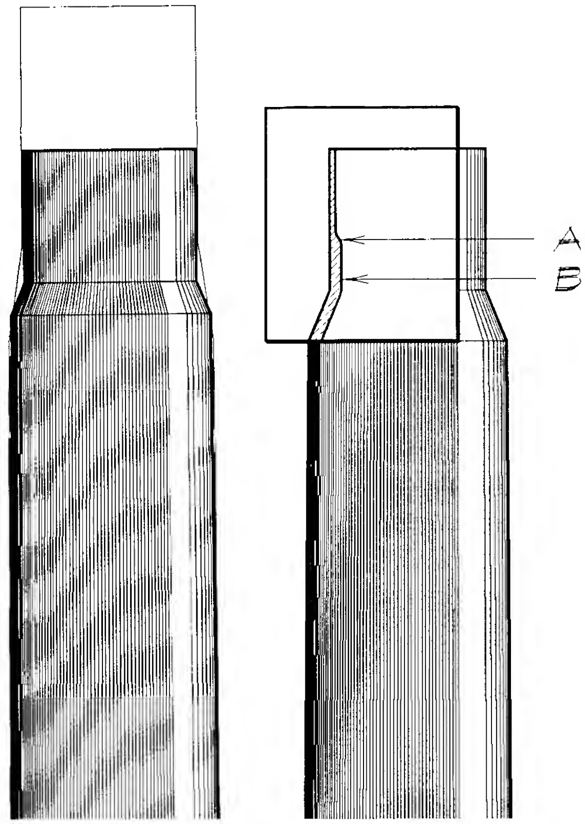
The general difference between the two operations is simple:

Turn case necks on the *outside* when the inside of the neck is on-axis but the inner and outer surfaces of the case mouths aren't concentric — one arc of the wall is thicker than the rest. Neck-turning makes the neck wall a little thinner, but the same thickness consistent *all around*, assuming it's consistent from the mouth down to the shoulder.

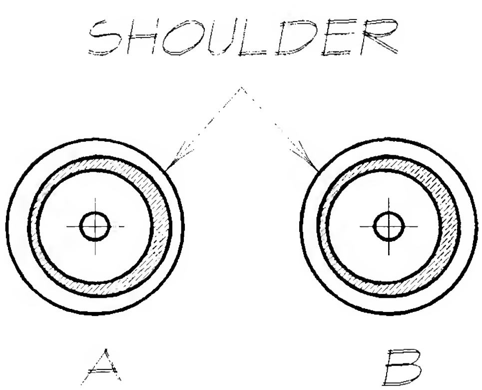
Ream case necks on the *inside* when the neck is too thick all around, when the ouside of the neck is on-axis and part of the neck is thicker than the other, or when a portion of the former shoulder or body makes the lower neck much thicker than the upper neck. Neck-reaming makes the neck wall uniformly the right thickness *from the shoulder to the mouth.*

One function of the case is to hold the bullet "launch-ready," in line with the axis of the bore. The neck of a snugly chambered case is a jig designed to hold the bullet so its long axis lies exactly on the barrel's long axis — not on it at an angle, not close beside it and parallel. If the *inside* of the neck is concentric with the long axis of the case (and therefore centers in the chamber neck), a turning tool can make the outside of the neck concentric, too.

But if the *outside* of the neck is concentric with the chamber and the rest of the case but the inside of the neck isn't, turning the neck makes



The unshaded outline of the .404 Jeffery shows how much of the parent case gets trimmed away to form a .416 Howell case. Just visible at the shoulder of the re-formed (shaded) case, the outline of the .404 case shows how much of the .404's shoulder forms part of the .416's neck, with a noticeable ledge (A). Turning the outside of the .416's neck wouldn't touch the extra thickness inside (B). The only solution is reaming away this extra thickness, with a .416 Howell neck-reamer and the accompanying die that guides the reamer.



If the inside of the case mouth is concentric with the rest of the case (A) and the outside of the neck is badly off-center, a good neck-turning tool is the "weapon of choice." If the outside of the neck is on-center and the inside is off-center (B), turning the outside down to an even thickness all around will leave the mouth still off-center. The only solution for this one is the neck-reaming set.

the outside of the neck off-center, too. Firing and resizing the case may correct this eccentricity but may not.

The necks of some re-formed cases are even and concentric — the same thickness all around — but too thick around the bottom. Three of my cartridges (.375 Howell, .416 Howell, and .450 Howell) have this inner belt, because the lower part of the neck used to be part of the shoulder of the parent case. The forward part of the old shoulder became the lower part of the neck when I pushed the shoulder toward the rear.

Turning these necks on the outside isn't the answer. With the case snug in its RCBS neck-ream die, the reamer reaches inside without affecting the upper part of the neck and shaves away the inner belt that reduces the diameter of the lower part of the neck.

All in all, I prefer the neck-ream die and reamer to the neck-turning tool, for one reason — dependable alignment. The turning tool revolves around a pilot pin that fits snug inside the neck of the case. Case necks are short and soft, so they give the short pilot pin a somewhat less reliably solid alignment anchor than the longer, harder neck-ream die and reamer.

The neck-ream die grips the entire case, snug from head to mouth, and extends far upward to form a long guide for the shank of the neck reamer. Both the die body and the reamer are long and hard, and the die-body recesses for case and reamer share a common axis. An off-center neck is more likely to get reamed concentric, while turning it is almost certain to keep it off-center.

The springiness of the brass is of course a factor in both instances, but I think it's more likely to be a problem with the turning tool. This elasticity means that the short, soft brass neck can't guide the pilot of the turning tool as steadily, consistently, and reliably as the neck-ream die grips the case and guides the reamer.

And don't forget, each case is a separate and different guide for the pilot pin of the turning tool. The neck-ream die and reamer shank align consistently and reliably the same way for every case, from the first to the last in a batch of a thousand or more.

I've never tried reaming necks with the cases and neck reamer hand-held or not fully supported by the special neck-ream die. I don't trust this method. If you try it, ream the neck *after* you've fire-formed it to its full diameter, *before* you size it down in the sizer die, to avoid making its inside diameter too large.

If a case neck is off-center and of uneven thickness, turning it to an even thickness all around leaves it off-center — since the turning tool shaves brass off the outside, concentric with the *inside* of the neck. Fire-forming this case forces the case-neck wall out against the wall of the chamber neck for that wee fraction of a second when the chamber pressure is up. For this brief instant, the case is as concentric with the chamber and bore as it can ever be — but when the pressure goes down, the brass relaxes, and the neck tends to go back to its original axis. The sizing die, as it squeezes the case into its own inner shape and along its own long axis, also forces the case into compliant concentricity. But when you withdraw the case from the sizer die, the springiness of the brass again warps the neck toward its original axis. This may be a problem, maybe not.

But if a case neck is off-center and thicker on one side, *reaming* it to an even thickness all around leaves it concentric with the case cavity and the reamer-guide recess of the neck-ream die. Springiness in the neck tends to return it to its former axis here, too, but reaming away the excess brass from the inside has in effect moved the mouth away from this former axis and toward concentricity with the rest of the case. Springiness therefore has less effect on the concentricity of the neck.

Turning rims, belts, bases, and extractor grooves is sometimes necessary — to reduce the diameter or thickness of the rim, remove the belt from a "magnum" case, reduce the diameter of the base, or cut (or recut) the extractor groove.

Chuck the body of the appropriate forming die in the lathe, then tap the case into the die with a light mallet.

Cover the die threads with a band of copper, aluminum, or brass —something soft — to protect them from the jaws of the chuck. Use something firm but soft between the mallet and the case, to prevent deforming or work-hardening

the head. Leave the decapping stem out of the die, so you can use a soft metal rod to tap the turned case back out.

Heroic Measures

Some of my predecessors and colleagues, thinking of nothing beyond ways to relieve a frustrated shooter's desperate obsession to make his old gun shoot, have endorsed heroic measures that range from dangerous to deadly — making cases from brass rod, soldering copper or brass tubing to case heads, grafting extensions onto cases to make them longer or bigger around, spinning case walls thinner in a lathe to lengthen cases, for example. If you try any of these, don't shoot that gun near me. I don't hanker to pick bits of your gun out of my hide — nor do I have any taste for picking warm pieces of you off the front of my shirt.

For safety's sake, forget heroic measures. Cartridge history includes several kinds of two-piece and composite cases, but they were all transitional developments, faltering steps in the forward march to good cartridge brass. Even in the days before smokeless powder and their high chamber pressures, they were developments best left to the wind like old powder smoke.

No cartridge is the only way to get the performance you want, so no cartridge locks you in with no alternative to heroic measures. There are few guns that can't be modified easily and simply for a different cartridge, to eliminate the last vestige of need for any of these extreme case modifications. Most guns, rifles in particular, can be rebored or rebarreled to accommodate bullets of a currently standard diameter. Most guns can also be rechambered to accommodate currently available cartridge cases.

These desperation measures are so fraught with guaranteed dangers and dissatisfactions, I am uncomfortable even discussing them for fear that merely mentioning them will stir some lout with lumber for thumbs into trying them just to see whether he can get away without blowing up something or someone. I've thought long and hard about discussing them here. At first, I was not going to mention them at all. But then the realization that the subject comes up anyway, with the concomitant attractive possibility of a long-sought answer to a problem, persuaded me that *not* discussing them would be irresponsible. If there's no warning here against them, a beguiled handloader would be less wary of them. Since I know nothing good to say about them, I trust (and hope!) that nothing I say here will encourage anyone to try them.

Sound new cartridge brass is too economical to be worth any risk to any firearm, not to mention any risk to life or limb. Only a few cartridges offer no alternative but home-made or jerry-built cases. Safety, performance, and economy all argue in favor of modifying the firearm to adapt it to another cartridge — even if you have to design a new cartridge for it — or retiring it to the living-room wall if that's not possible.

And don't fall for ballyhooed recent "improvements" that allegedly strengthen cases by screwing new steel heads onto brass case bodies. I wait with dread for the first report — due any time, now — of the first victim of this so-called advance in case design. I hope the first incident turns out to be no worse than a good scare — at worst a mild maiming — and hoists a red danger flag to warn everyone near and far who might be tempted to try these dangerous cases.

They offer a false assurance of increased strength while they encourage dangerous pressure increases. I don't want anybody shooting one of those close to me, either. I wouldn't want gun fragments in my hair even if I had hair.

Three simple little words sum up all knowledge and all wisdom about heroic measures to modify or to adapt cartridge cases: *Who needs them?* In my favorite Gary Cooper Western, *Along Came Jones*, Coop's curmudgeon sidekick George (William Demarest) tells him, "I was mixed up in a little shootin' once. I just can't tell you how quick I got sick of the whole idea." I've never been around when a gun blew up, but I was sick of that idea long before I saw what was left of one that had blown up or what the pieces of one had done to somebody.

If there's a better way to get the case I need, I don't even like turning down case rims or bases on a lathe. I have no idea how many flavors of custom cartridges I've done up in the past forty years — a bunch, I know — and I've gotten along well indeed without even this quasi-heroic

measure. The alternatives are just too plentiful and easy. Which is not to say you can take them lightly, ignore them, or give them a lick and a promise and call them done.

Good cases cost less than a good gun or a myopic eye, but they're investments that keep soaking up time, effort, and money. To make the best and the most of this investment, there's no corner worth cutting. A shortcut that saves you fifty paces and plops you into a mudhole up to your knees is a poor route for any kind of travel.

I won't tell you how to do anything I don't think you ought to do, of course. Heroic measures always introduce risks. Some of these risks are only moderately scary, to moderately cautious shooters. Others are nasty enough to warn away anybody with one brain cell still working. Heroic measures require extreme care in modifying the parent case, then extraordinary restraint in loading it to only moderate pressures.

Heroic measures are the most dangerous to obsessed shooters, especially to those obsessed with velocity. Loading for maximum performance *always* means stark, shivery danger when you derive your brass by heroic measures. If you contemplate extreme measures that seem to offer a desperation way to get the brass you need, also consider the risks in the brass-massaging these measures require.

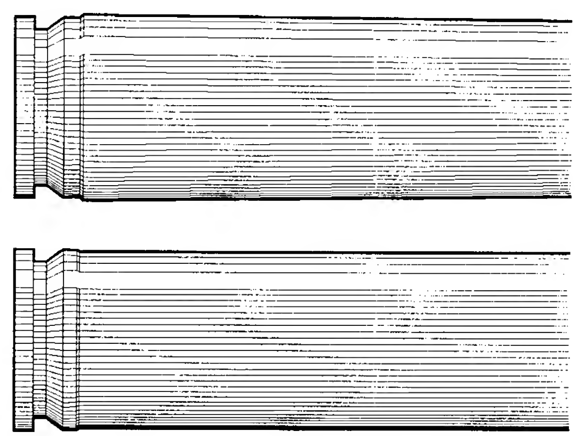
There's always a better choice, even when the only alternative is to abandon all hope of ever shooting that gun. There are other guns, remember. How many eyes or hands can you spare?

Several of the drawbacks peculiar to heroic measures come in pairs. Notice in this short list how often one liability of an extreme case modification combines with another:

¤ Heat is anathema to hardness in critical base areas. So forget, right now, any procedure that involves soldering or sweating anything to the case.

¤ Working case heads hardens the brass, maybe too much. Don't reduce the base diameter of a case by more than three to five thousandths of an inch (0.003 to 0.005). Extreme swaging squeezes the web, like tightening a watch strap around a doughnut, and partially collapses the primer vent. The web becomes brittle, the primer vent too small. You can of course drill out the vent, but you'd do more harm than good if you annealed the head to reduce the brittleness of the web. Don't expand the base of a case by more than five to eight thousandths of an inch (0.005 to 0.008). The web won't expand enough to support the bulge that forms as the case walls expand to the diameter of the chamber.

¤ Bushings or girdles drastically reduce case capacity and weaken case walls. Added wall thickness reduces case capacity drastically. Swaging or sweating a metal girdle around a case, to make it fit a chamber significantly larger in diameter, *always* reduces the capacity of the cartridge enough to make it a totally different cartridge internally and ballistically. Let's construct a ridiculously extreme example to illustrate what happens. If you surround a .222 Remington case with enough brass to adapt it to a .22-.250 chamber, it is *not* a .22-.250 case, and long before you can melt or cram a .22-.250 load into it, you're going to send little bitty pieces of your rifle hither and yon. When the differences are more subtle than in this ridiculous example,



The practical limits of case adaptation may be too narrow for any available brass to be suitable for the obsolete, exotic, or unique cartridge you want to load. The limit of expansion at the base (upper drawing) is 0.005 to 0.008 inch larger in diameter. Swaging the base smaller (lower drawing) risks excessive working of the web and partially closing the primer vent. The practical limit of safe base-swaging is 0.003 to 0.005 inch smaller in diameter. (The lower drawing shows base-swaging only partially completed, to contrast the base diameters before and after swaging.)

safe loads for the reduced net capacity of the patchwork case lead to frustration that in turn can lead to recklessness. Unless the added brass encloses the case from end to end, a bulge or crease forms at one edge of the bushing. A sharp, extreme double bend encircles the case, and the case is weaker along this crease.

- Seams and creases encourage parting. Lengthening a case by soldering, sweating, or swaging on an extension produces a seam where the smaller-diameter portion of the case fire-forms out even with the larger-diameter extension sleeve. A girdle around part of the case also produces a seam.
- A sleeve can shoot loose, blow into the bore, and if not detected and removed can ruin a shot or a barrel if not your whole day. The alterations that make heroic measures crazy encourage one part of the composite case to come loose from the rest of it. I've even had this happen with a batch of one-piece factory-loaded Remington .357 Magnum cases with overly deep case cannelures. They were just a double nuisance in revolvers, but one I fired in a .357 carbine separated at the cannelure. The neck section rammed forward into the throat, where it hoisted the peak pressure of the next round. The next bullet had to squeeze through a much reduced hole to get into the barrel. No wonder that bullet went who-knows-where.
- Sleeves and case extensions defy consistency. Consistent precision disappears when you try to convert one case into another by adding brass to it. Making just one case is no problem. But making another one exactly like it is at least a dickens of a nuisance. To make more than two cases come out with exactly the same dimensions, capacity, hardnesses, and weight, you'd have to make all that brass jewelry as precisely as if they were high-quality tools, dies, or instruments — and they'd still be second-rate compared to decent ordinary brass.
- Thinning case walls weakens them and doubly encourages splitting. Spinning or "redrawing" a too-short case to make it long enough to reach the front end of another cartridge's chamber is tough enough, even if it would produce half-decent brass. But even a little brass pulled forward to extend the mouth of the case has to come from the rear, obviously, leaving less back there. The useful life of the newly formed case is approximately as short as its walls are thin. Do it once, and you'll have to do it again, so this is a good case modification only if you really like to do it. Also, unless you're extremely adept at spinning or redrawing the case wall forward in a long, even taper, you'll leave an abrupt step at the rear of the thinned section. The case will likely separate at this seam, partially or completely, sooner or later.

Checklist

The best way to—

- push shoulder back — forming or sizer die
- push shoulder forward — fire-form the case with inert filler
- enlarge neck diameter — fire-form the case with inert filler
- reduce neck diameter — forming or sizer die, dies, or combination
- enlarge shoulder or body diameter — fire-form the case with inert filler
- reduce shoulder or body diameter — forming or sizer die, dies, or combination
- enlarge base diameter — fire-form the case with inert filler (but no more than 0.005 to 0.008 inch larger diameter)
- reduce base diameter — use special RCBS base-swage dies, which often require an arbor press (but no more than 0.003 to 0.005 inch smaller diameter)
- enlarge rim diameter — a little *careful*, discreet peening around the forward face
- reduce rim diameter — turning
- reduce rim thickness — turning (from the *front* only. If you turn brass off the rear face, you also make the primer pocket too shallow, and there's no good way to deepen it.)
- remove belt — turning
- shorten cases — RCBS trim die, hacksaw, file, trimmer, Sandia case cutter (source listed in Chapter 7)

Chapter 5

Find or design one you like.

A FELLOW saw his friend crawling around looking for something on the pavement under a street light. "What did you lose, Mike?"

"Shtarted unlock m' car. Dropped keysh."

"But your car's over there on the other side of the street."

"Yeah. Light'sh better here."

The fellow who looks for his car keys under the best light — not where he dropped them — has to walk home, hook a ride, or call a locksmith. If we can shine the light where the cartridge keys lie and you look there, you may not have to forgo the custom cartridge you want. You probably won't have to "walk home" (get along with what you have, even if you have nothing), "hook a ride" (settle for whatever you can get easily), or "call the locksmith" (have someone cobble up something for you). The special cartridge you want may already exist. It may not. You may have to design it from scratch — no big deal.

Good cartridge information is all over the place — and that's the trouble. It's usually just a little here, a little there, some confusing, some misleading, a lot incomplete, a lot more in the wrong places, much of it hard to find even when you know what you want.

At least a few dozen excellent but unnecessary cartridges have joined the growing roster because the light was not good where the key data lay. The fellows who designed these cartridges didn't know they already existed under other names, with nearly or exactly the same dimensions. Those fellows could have saved themselves trouble, time, and expense if they'd known. Or they may have decided to design something else — something better. Either way, they could have based their cartridge choices on better information.

One purpose of this first *Custom Cartridges* book is to help you discover whether you may have to design a new cartridge if you can't find one that will give you what you want. Anything "new" you might dream up is most likely out there somewhere already — either exactly what you want or something so close to the same thing that ignoring one of these equivalent or nearly equivalent cartridges leads you to waste your time and money. But the cartridge you want may not exist yet, and it may be easy to design — especially if you know what's already out there for you to work with.

The drawings in this collection include at least a dozen cartridge cases that other designers have used as design bases for their cartridges. The .30-06 Springfield case, for example, is the basis for hundreds of other cartridges — some have SAAMI pedigrees (*e g:* the .270 Winchester, .280 Remington, .25-06, .35 Whelen). The others are all still wildcats (*e g:* the .338-06s,.375

Whelens, 6.5mm-06s, 8mm-06s — the several versions of each).

Factory and wildcat cartridges based on the belted H&H magnum cases are also plentiful. Modified .308 Winchester, 7x57mm Mauser, .30-30 Winchester, .30-40 Krag, .348 Winchester, .404 Jeffery, .223 Remington, and .357 Magnum cases add hundreds more cartridges. And there are more on the menu of cases good for modifying. Any case that's reasonably available in decent quantities is a good candidate for a new cartridge design.

Designing a new cartridge is often worth all the thought and cost, but it does cost. Whether you make your own reamers and headspace gauges or have one of several superb reamer companies make them for you, these little jewels can cost a staggering wad of money. If you're having them made so you can chamber only one gun for your new cartridge, their cost becomes one of the major line items in the final cost of your gun.

If you have to order special reamers and gauges, expect to pay more and wait longer for having your own design done up than you'd have to pay and wait for an existing set of reamers for nearly or essentially the same cartridge. A careful cruise through the dimensioned drawings in Chapter 6 may save you time and money.

Any of the best reamer makers (Chapter 7) already has an impressive variety of reamers and gauges either on the inventory shelf or on the computer that runs their machines. Chances are that some cartridge or other in their portfolio is so close to what you want, you won't have to pay a higher figure for any new cartridge design.

They'll no doubt have this book on their shelves, and simple reference to "the cartridge at the top of page so-and-so in the cartridge blue book" will tell either of you exactly which cartridge the other is talking about. If some of the reamers and gauges they already make are satisfactory, you can save time and money by not having to go through any of the back-and-forth discussions that would otherwise be necessary to determine and specify all the dimensions for a set of custom reamers and gauges.

These savings can amount to weeks — or even months — and hundreds of dollars. Even a minor modification of a cartridge already in their portfolio is likely to cost less than making something entirely new from scratch. Starting over often means making mistakes and having to junk some costly first reamers or gauges.

Another purpose of *Custom Cartridges* is to support the notion that designing a new cartridge is often not only desirable but worth the trouble and expense. Maybe you don't know exactly what you want but have a general idea. Have fun window-shopping Chapter 6. I'll offer a few shopping tips to help you focus on your wants and purposes so you can find what you want if it's already available.

If the cartridge you want isn't yet a known design, then we'll talk about how you can design it yourself to get exactly what you want. Whether you have to design your own or you just want to do it, you're in the company of an honorable multitude of serious shooters.

Thin little minds, seared brown to shut out thought, try to pin cheap motives on our backs like tails on a party donkey, but several excellent reasons and purposes lead independent enthusiasts to design new cartridges even though some of them seem to be merely imaginative solutions to imaginary needs. One corollary to Howell's First Law of Physics (*The load is always lighter when the other fellow totes it*) is that one fellow's need or purpose often means little or nothing to anyone else.

Ignore thin little brown minds. Decide what you want, find out how to get it, and do what you have to do. If you still don't know exactly what you want in a cartridge, stroll through this collection of cartridge drawings until that One Great Cartridge forms in your mind. Whether you find it here or make it up on your own, you'll know how to specify dimensions for the chambering reamers, headspace gauges, and dies you need.

Mark Twain certainly felt that each of us ought to go our own way. He said (approximately): "If a man wants to carry two cats home by their tails, I say let him. He'll learn things he'd never learn any other way, and the memory will never fade or grow dim."

That's good enough for me. There's no end to the good reasons for independently designing another cartridge, even when there's already a cartridge so much like it that like some identical

twins, only their mother can tell which is which. Whatever your reason or purpose may be, I'm with you. Design away. I'll try to help.

Twain didn't like Jane Austen's books. I've been told he said, "A good way to start a library is to leave out Jane Austen." I've taken the opportunity as designer, author, editor, and publisher to get this book off to a good start by leaving out a score or more of my own designs. I'm not going to tell you what they were or why they're better left out. If you knew, you'd thank me for leaving them out — but you'd question my judgment in dreaming them up in the first place. So I'm not about to confess to the ones I designed out of ignorance and poor judgment, and I'm not including a few I "designed" as gags (a .458-06, a .44-.357, and a .17-.460 Weatherby Magnum, for example).

I have included several decent, reasonable cartridges I've designed but haven't identified all of them as my cartridges. A few bear my name. Most don't.

My reasons for designing them have never included any of the cheap motives so often attributed to independent cartridge designers by shooters and writers who don't know what we're about or what they're talking about. These fellows see no need for new cartridges, so they figure we can't have any good reason for them. They trust the motives of commercial designers but don't give us any credit for seeing needs or uses they don't see.

The doubters distrust all privately designed cartridges, although some of the finest SAAMI-pedigreed factory cartridges began as wildcats and earned reputations that finally made them too attractive for SAAMI's member companies to ignore them any longer. The doubters trust pedigreed cartridges, of course, although many of these cartridges owe their existence to reasons and purposes that have nothing to do with careful ballistics engineering and design.

So let the doubters doubt and the worriers worry. If you have even a faint interest in a new cartridge, look through the drawings in Chapter 6 to find or define the cartridge you want. Chapter 7 will direct you to other sources you may want to look into for other cartridge information, either before or after you've decided whether you want to adopt an existing cartridge or to design your own. Cruise or peruse *this* chapter for tips and reminders to help you—

—find an existing cartridge you like

—design the cartridge you want, if it isn't among those drawn in Chapter 6

—tell your gunsmith which reamers to use on your gun, or a reamer manufacturer which design to use for your reamers and gauges.

Custom Cases, or ...

You may not even have to form custom cases at all. Or you may not be able to make the one you need. For a few obscure, old, and foreign rifles and handguns, there's just no other brass you can modify to make the case you need. For a few more, you have to use brass that requires more work than makes good sense.

Some case modifications are questionable to risky — but since my hide and its prized contents are intimately close to every case I load and every gun I shoot, I've always shunned any case modification that put me at risk at either the loading bench or the shooting bench. I've always found a safer and easier way to get what I needed, without sacrificing performance. There's no secret formula — just consider all the options.

Sometimes, it's smart to modify the rifle or handgun — not the brass — to give it a new voice. Or you may want to modify the gun to use a cartridge you can make more easily than its original cartridge. Remember, you will have to modify *every case* you intend to load. My personal minimum is a hundred cases for a rifle, five hundred for a handgun. For some varmint rifles, I prefer a lot more — at least several hundred to a thousand or more — however many I can expect to shoot on that best varmint shoot I hope to enjoy some day. Modifying one case is simple. Modifying a wheelbarrow load of even the simplest cases can take enough work to raise blisters on your fingers — before you load any, which in itself takes enough time and care.

A new barrel or cylinder changes everything, of course, if your mute gun is one you can rebarrel or fit with an appropriate and available new cylinder. Sometimes a new chamber or bore (or both) in your old barrel is all it takes to convert a rifle to a currently available factory

cartridge. The option of modifying the rifle or handgun isn't always available, possible, desirable, or the better choice, but I have to mention it in case you don't know of it or haven't thought of it. It's more often a good option for giving a rifle a new voice, but it's sometimes worth considering for a handgun, too.

If the possible combinations of a new or modified chamber and a new, larger bore don't include a currently available cartridge — factory or wildcat — it's a simple matter to design a custom cartridge to use easily available bullets and cases.

A couple of weeks ago, a friend asked me what brass his brother could modify to make an obsolete and exotic heirloom shoot. The only brass he can use is belted, and to make it fit the old rifle's chamber, he has to turn the belt off each case, then fire-form it, trim it to length, and deburr the mouth.

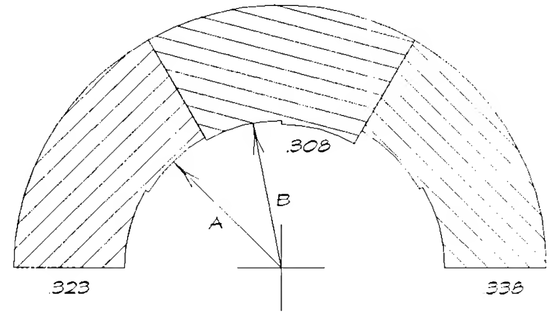
If that gun were mine, I'd work on the chamber and leave the belt on the brass. I'd simply modify the chamber to accept the belt, a simple job — in this instance — with a reamer. One simple and partial rechambering, in my opinion, beats the dickens out of turning the belts off a bucketful of cases.

Another friend faced a parallel to this problem some years back. First his grandfather and then his father had used the grandfather's .30-06 Springfield so extensively that after Bill had used it for several more years, it wouldn't shoot a one-yard group at a hundred inches. Bill didn't want to retire the rifle, but he also didn't want to rebarrel it. Its family history mandated leaving it as original as possible.

He didn't know reboring was an option until I suggested it. His .30-06 soon became a .35 Whelen, with an entirely fresh start on another long life of service to however many shooters would use it before the barrel would again be too worn inside for further service. Yet nothing on the outside of the rifle was different. Modifying the rifle in that way had given it new life without insult to its family history.

The original .30-06 chamber in Bill's rifle was clean enough to serve the new cartridge. But if it had been pitted, or if it had been reamed for a cartridge he could no longer get brass to fit, his chamber could easily have been reamed larger for a new case — more easily, in fact, than reboring and rerifling its worn-out .30 barrel to accommodate .358 bullets.

Years ago, when hundreds of good Mauser rifles had preceded good 8x57mm ammunition into the United States, many shooters simply rechambered their Mauser barrels to accept the .30-06 Springfield case necked to 8mm, giving birth to the 8mm-06 custom cartridge. The same modification of 7x57mm Mauser rifles gave us the superb 7mm-06, which was also known then as the .285 OKH and eventually made "legitimate" as the .280 Remington. Other examples like or paralleling these abound. Rechambering and reboring offer an *either-or* and a *both-and* option. Depending on the gun and its hard-to-replicate cartridge, it's easy to give it a new shooting life by reboring or rechambering the original barrel, or by both reboring and rechambering it. The possible combinations are limited, but there are enough possibilities to make all extreme or heroic measures as unnecessary as they are unwise. And of course there's also the option of fitting a new barrel if there's no need or desire to keep the old barrel in active service.



Reboring a useless barrel can make it usable again if the new bore diameter (twice radius A) is appreciably larger than the old groove diameter (twice radius B). Reboring a .308 barrel to .323 (8mm) may not "clean up" the old bore surface, especially if the bore is deeply pitted. The new bore for an old .308 should be at least a .338. If there's enough steel (at least 0.120 inch of barrel wall remaining at the muzzle), the new bore can be a .358, a .375, or even a .458. This unavoidable dimensional requirement obviously limits your choice of a new, custom cartridge —whether you select an existing design or make up a new cartridge all your own.

Why design another cartridge?

Who designs new cartridges, and why? The companies that make and sell ammunition, gun manufacturers, shooters — never, I'm sure, collectors, historians, investigators, examiners — and certainly no one who expects a new cartridge to make him rich and famous unless he plans to sell a lot of guns or ammunition. The companies want sales. Shooters want performance, accomplishment, results. The companies sometimes design new cartridges to give shooters the results shooters want, but not as often as the critics of wildcats assume.

Let's look at the reasons and methods that lead to new cartridge designs, see who uses these methods for these reasons, and leave it to everyone to judge their merits for himself.

"Is it necessary?" Is it necessary to ask "Is it necessary?"? Who decides whether a new cartridge is necessary? By whose criteria? I once wrote, lightly but not in jest, that anyone who had to justify acquiring another gun was a sad and deprived individual indeed. When an engineer friend in the firearms industry remarked that we shooters needed no new cartridge, the debate ended in laughter at my retort that if need were the only criterion, the shooting world could get by just fine with no more than three to five cartridges. Need is neither the only nor necessarily the best justification for a new cartridge. The old Latin adage *de gustibus non disputandum est* (taste is not disputable) is justification enough. Whatever you want or why you want it, your reasons are as good justification for you as mine or anyone else's are for us. They need no defense or excuse.

So what's the first step? In Winchester-Western Technical Bulletin #1 (14 September 1962), James G Baker's *The Development of a New Cartridge* (which I'll abbreviate W-W TB-1 when I refer to this bulletin), Baker wrote: "The first step in developing a new cartridge is, of course, to determine the performance characteristics which are to be the desired objectives."

This is *one* first step, an excellent one, based on the premise that the *raison d'être* of the new cartridge is its performance. Baker continues:

"As an aid in determining these performance levels, it is pertinent to review the trends in cartridge and shot shell development which have occurred over the period of the last 90 years, since the introduction of the breech loader. From these trends, it is possible to determine the approximate performance requirements of any new cartridge or shot shell which is to be successful today.

"The performance trends during the past near-century which are of interest are:

"1. Smaller and lighter cartridges.

"2. Increased effective range.

"3. Increased power (energy) levels.

"4. Increased velocity levels.

"5. Reduced recoil (or recoil control).

"6. Reduced firearms maintenance.

"7. Increased cartridge storage life."

In W-W TB-1, Baker loosely details some of the official design thinking that led to the .264 Winchester Magnum, which Winchester-Western had conceived "in answer to the need for a high-intensity cartridge which would be capable of safely out-performing certain 'wildcat' cartridges. (Many of these cartridges have considerably overadvertised performance, which is often attained at dangerous pressure levels.)

"First, it was determined that Winchester-Western needed a cartridge with the following performance characteristics:

"A. Flat Trajectory,

"B. High Retained Energy,

"C. Low Wind Drift,

"D. Moderate recoil, and

"E. High initial velocity (if compatible with the first four requirements)."

These are all excellent criteria for either selecting or designing a new cartridge, whether they arise from Winchester-Western's desire to compete with wildcats or from an individual shooter's desire for better performance.

I wish their new cartridge had turned out better than it did. But the next logical criterion (F. Long Barrel Life) didn't appear on Winchester-Western's list of desirable performance characteristics — to the chagrin of a physicist-ballistician friend whose careful studies led him to expect the .264 Winchester to be the finest long-range plains-game cartridge of all time. Before he could develop a satisfactory handload for his .264, his barrel went sour.

Since Baker's time, the major manufacturers of guns and ammunition have based their new cartridge designs and adoptions primarily on other sales-centered criteria:

- whether a metric or a caliber cartridge designation would sell more ammunition
- which caliber (or bullet diameter) was most popular — the "*calibre du jour*," so to speak
- which well established, popular wildcat cartridge — if it were honored with a SAAMI pedigree — would boost sales of their guns and ammunition

All these other criteria boil down to one *raison d'être*: selling more and more guns and ammunition, to keep the companies growing financially. At Remington and Winchester seminars (for gun writers) I've attended, company executives laid out their reasons for us and explained their research. Their basic premise was never, as Baker recommended, cartridge performance. So their research didn't begin with interior, exterior, or terminal ballistics.

The premise basic to typical Remington research, for example, was often "We need a new [metric or magnum] cartridge to increase sales of our rifles and ammunition." The purpose of typical design research was to find whether yellow boxes with green lettering or green boxes with yellow lettering would sell more Remington rifles and ammunition — not to find or design whichever new gun or cartridge shooters wanted. When other Remington research determined that cartridges with metric designations sold better than those designated by caliber numbers, Remington changed the names of some of their cartridges from caliber designations to "more marketable" metric designations.

Their .244 Remington became the 6mm Remington, and later the .280 Remington became (for a while) the 7mm Express Remington, because some of Remington's chiefs figured that a name change was the way to boost sales that weren't good enough under the older names of those cartridges.

Or they assigned their designers the task of ginning up new metric cartridges — the 7mm-08 Remington and the 8mm Remington Magnum, for example. The ballistics of the new cartridges became a matter of concern only secondarily, when the SAAMI standards demanded satisfactory ballistics in safe mass-produced guns and ammunition. The flavor of the new names, and the sales appeal of that flavor, primarily defined the new Remington cartridges.

One Winchester seminar included detailed explanations of research into which cartridge-box design would sell the most Winchester ammunition (and writers' samples of the best-selling cartridge box).

Another example: after Winchester had approved my proposal and accepted my design for the cartridge they intended to introduce as the .416 Winchester Express, the "Mahogany Row" instruction to their development people was (approximately, not *verbatim*) to "Modify Howell's original .416 Winchester Express cartridge (a) to exploit the length and diameter of the Model 70 action and (b) to create a belted magnum cartridge intermediate in power between the .378 and .460 Weatherby Magnums."

Winchester's modified version would use the larger, longer basic case of the .378 and .460 Weatherby Magnums instead of the shortened .404 Jeffery case. The efficiency, performance, and economy of the cartridge were not their criteria, as Baker and most performance-centered shooters would assume.

Instead, the .416 Winchester Express — aborted when the Olin Corporation sold the Winchester works in New Haven to United States Repeating Arms Company — was to have been a promotional vehicle to increase the sales of Winchester Model 70 rifles and Winchester ammunition. So much for the blind trust that leads the critics of wildcat cartridges to assume that the companies know best how to design good, safe, practical, effective cartridges, and that they base their designs on practical ballistics and performance — as wildcatters typically try to do.

Wildcatters just don't start with the same premises the gun and ammunition companies start with, but the twain occasionally meet to give us some cracking-good factory cartridges. When a friend of mine was riding the gee pole at the United States Repeating Arms Company, he wanted to introduce a new rimmed cartridge to promote their new Big Bore 94 and asked me whether I had designed one I'd recommend. I

suggested he get in touch with Ken Waters and get the details of Ken's 7mm-.30-30 wildcat. Federal agreed to make the ammo. SAAMI gave Ken's feral kitten a pedigree, and the "new" 7-30 Waters hit the market as a "legitimate" factory-named, factory-chambered, and factory-loaded cartridge.

I certainly don't deride these companies for wanting to sell more guns and ammunition. I wish them all the best and hope they thrive increasingly. But directly opposite the jeerers' sneers, I consider the typical premises and eventual designs of wildcatters more honorable and more in line with J G Baker's premises — more in line, in fact, with the premises even the jeerers consider admirable, premises that with logic but in ignorance they attribute to the companies.

So all my comments here, then, are support for independent design by individuals — you among us, if so you lean — *not* condemnation of the companies or their purposes, which I consider understandable, practical, legitimate, and honorable. I just want everyone to know and understand exactly what the factories start with when they set out to introduce a new factory-legitimate cartridge. We owe their reasons, for example, for giving us good *factory* guns and ammunition for these great wildcats:

.22 Hornet
.22 PPC
.22-.250
6mm PPC
.243 Winchester
.244 (6mm) Remington
.257 Roberts
.25-06
7-30 Waters
.280 (7mm Express) Remington
7mm magnums
.300 Winchester Magnum
.338 Winchester Magnum
.35 Whelen

These and other fine cartridges (designed, developed, introduced, proven, and financed by independent individuals) earned enough popular demand to offer the gun and ammunition companies a ready-made market they could exploit without the usual expense of designing, proving, developing, and promoting their own original cartridge designs. Independent designers create our new cartridges from a wider range of premises and for a wider range of purposes, seldom if ever to pump new blood and breath into sales. No cartridge designer I've never known was driven by the urge "just to have his name on something," as those thin little brown minds have so often alleged.

A few have simply wanted to create something new, but that wasn't their only or primary motive. (And if it were, the drive to create is unquestionably legitimate for poets, novelists, painters, sculptors — so why not *and for shooters*?) A personal appetite for the satisfaction of having created something new usually accompanies (and helps drive) the more basic desire to fill a need or serve a purpose. Most often, a cartridge designer wants his creation to fill a need or serve a purpose. His design is most likely to be some kind of compromise between the two nearest bracketing cartridges.

The urge to feed or satisfy his ego is not often a cartridge designer's reason for a new cartridge. But while this motive may not seem admirable, it is legitimate enough to deserve no one's condemnation. I know of no cartridge that someone conceived for ego satisfaction alone. The best cartridges are probably more likely to come from the germination of other mental or emotional seeds. Even the desire to use a unique cartridge — one nobody else uses — is legitimate, with plenty of good reasons that really matter only to the fellow who wants his own private cartridge. He may, for example, just want to discourage a thief from stealing a gun he can't use without rare special cartridges.

A moderately well known gun writer, when he was much younger and probably less mature, told me he expected his writing to make him rich and famous. I could think of only one route that would be less likely to lead him to his declared primary goals. Designing a cartridge is no road to fame or wealth — it's more likely to cost money and to generate ridicule from the few people who don't yawn. The money-making opportunities in designing cartridges reminds me of the table-weary gambler's foolproof, simple formula for taking a small fortune home from Las Vegas — take a large fortune *to* Las Vegas.

Excellent cartridge designs often arise from someone's strictly personal need to adapt available brass to substitute for a cartridge he can't buy anywhere — for an obsolete or exotic firearm that can't use currently or easily available ammunition, for example. The ammunition originally intended for that firearm may not be available at all. It may be available only at great expense, only in small numbers, only in low-grade or otherwise unsuitable ammunition, or only now and then. A custom cartridge may be the only economical or acceptable way to return that gun to use. If neither a factory cartridge nor a custom cartridge is already an option, this fellow is a natural to design his own.

Or his gun may have a poor chamber or bore, or both, while for some reason rebarreling it isn't a good option for him.

One of the most common reasons for designing a custom cartridge is the need to substitute available brass or bullets for ones that are impossible, impractical, or inconvenient to obtain. The .338-06 is the much older .333 OKH slightly redesigned to use .338 bullets, which are more readily available — and in a greater variety — than the .333 bullet Speer used to make. The 8mm-06 adapted war-trophy 8x57mm Mauser rifles to the most readily available American cases when good 8x57mm brass was hard or impossible to get.

One shooter's .257-.350 Magnum antelope cartridge derived from his opportunity to exploit a large and virtually free supply of .257 bullets and .350 Magnum brass. At a gun show, he bought a fine .257 Roberts sporter for a pittance because of a deep gouge in its chamber. He thought at first he would rechamber it for the .25-06. Then, at the same show, he traded meaningless (to him) odds and ends for two hundred once-fired .350 Remington Magnum cases and a couple of thousand .257 bullets — and had the good sense to see what he could do with them all. I worked out the dimensions for him, and he rechambered his .257 Roberts sporter to his new one-of-a-kind custom cartridge.

He couldn't care less that there's probably no other .257-.350 Magnum anywhere in the world, or that no one has ever written an article about it anywhere — especially when he drops a pronghorn with it at a very satisfying long range. He doesn't care that his cartridge came into being through pure convenience and a few strokes of good luck, not from careful ballistics engineering, nor as an answer to a popular clamor for a short, belted .257 cartridge with about the capacity of the .25-06.

A custom cartridge may owe its existence to someone's desire to adapt components and performance to a certain type of firearm. Bo Clerke designed his .38-.45 to adapt the Colt Government Model pistol to a necked case, to produce a .38 midrange cartridge that would feed and headspace better than the .38 Special, which so many pistolsmiths had been struggling to adapt to the Colt auto.

Clerke's necked cartridge improved feeding, all right — even empty .35-.45 cases chambered from the clip without a hitch. And the shoulder provided solid headspacing even when the handloader crimped the neck around a cast bullet. (His goal was not, as so many gun writers have erroneously supposed, the hot velocities of the .357 Magnum.)

The recent availability of .400-.350 and .400 NE Basic brass makes it possible now to design custom cartridges to adapt any cartridge based on the .30-06 Springfield, .308 Winchester, or 7x57mm Mauser case to lever-action, top-break, and falling-block actions that work best with rimmed cartridges and work poorly or not at all with rimless cartridges.

At least a couple of independently designed cartridges arose from the urge to comply with the letter of a law and circumvent its clear intent. The .228 Ackley and the .230 LLF met the letter of laws written to forbid the use of .224 centerfires on big game, while they circumvented the intent of those laws — written to compel hunters to use significantly larger-bore rifles on big game.

The major manufacturers of guns and ammunition aren't the only originators who design new cartridges primarily to sell the guns, the ammunition, and the components they make. Several smaller companies and gun shops have also designed their proprietary cartridges for no other primary reason or purpose. But their cartridges aren't necessarily inferior or superfluous simply because they want to corner a segment of

the market by requiring the buyers of their guns to use their ammunition.

Most often, it is the independent designer or "wildcatter" who designs a cartridge primarily to improve something or other. Usually, the purpose of the design is to increase power (higher velocity, larger bore, heavier bullets). *Improved*, *Super*, *Magnum*, *Express*, and other power words in cartridge designations reflect this design goal.

Many another custom cartridge has come from someone's desire to moderate power (to reduce velocity, cost, weight, or recoil). The late Frank Barnes's lopped-back versions of the .308 Winchester (.308 1.5-Inch) and .458 Winchester Magnum (.458 1.5-Inch and .458 American) are excellent examples. Just as often, the designer's driving desire is to improve performance (accuracy, efficiency). The many recent bench-rest and silhouette cartridges owe nothing to an obsession for higher velocities or a bigger hammer for dangerous game.

The desire to improve effectiveness on big game may lead a wildcatter to enlarge a case body and bullet diameter and ignore any concomitant loss of efficiency. The desire to retain or improve efficiency (which I'll define and illustrate anon) exerts an entirely different influence on cartridge design. The goal of greater effectiveness has no doubt led to more cartridge designs — but for my money, efficiency inspires better cartridges.

A Montana shooter told me that while he was "laid up with a crumpled leg after a car wreck" for six or seven months, he "mostly sat or lay in bed and read gun books, and drew cartridge designs." He simply enjoyed designing cartridges, so he designed dozens or hundreds, including some "hare-brained stuff I didn't have money to build anyway." Who can reasonably say that designing cartridges as a therapeutic pastime is less honorable or legitimate than, for example, introducing new metric factory cartridges because metric cartridges seem to be the market favorites of the year?

Therapy is at least as legitimate as monetary profits, and I'm sure this shooter has designed some practical cartridges. The perfect answer to one man's needs is often risible to others who can't even imagine those needs.

Why I Designed Some of Mine

Examples of the reasoning and purposes behind a few custom cartridges may illustrate most clearly why privately designed cartridges come into existence. In several magazine articles (including some reprinted in the second volume of *Wildcat Cartridges*), Ken Waters has already told why he designed some of his special cartridges. I know why a few other fellows designed their custom cartridges, but I can more accurately and clearly tell you why I designed some of mine.

I designed the .17 and .22 KEHornet (with other designations) after a friend whose company manufactured first-quality small-bore rifles asked me to suggest a small cartridge to promote his company's new center-fire rifle action. He didn't adopt either cartridge, so my two little cartridges are now wildcats.

One of my design premises was factory standardization of the .17 and .22 K-Hornet, which already existed in a wide variety of wildcat versions. I made the case body longer so the factory rifles could chamber wildcat versions of these rimmed cartridges, but wildcat chambers would not accept the factory cartridges.

I designed the .30-06 Rimmed and its several siblings to adapt some of the best and most popular rimless (*i e*, bolt-action) cartridges to certain top-break and falling-block single-shot actions and lever actions with extractors designed for rimmed cartridges.

The .338-06 is an outstanding wildcat, in some ways better than the justifiably famous .35 Whelen. I had just arranged for Paul Marquart to make me a couple of barrels for a .338-06 and a .280 RCBS when I realized that the body of the .280 RCBS would doubly improve the .338-06. I knew Paul would grind his own reamers for these two, so I asked him to use the same body and shoulder dimensions for both.

So my .338-.280 RCBS increases the capacity of the basic .338-06 both by enlarging and lengthening the body of the case and by making the shoulder angle steeper. The result is a case with the length and base diameter of the .30-06 and .35 Whelen, that gives all but the heaviest

.338 bullet the exterior and terminal ballistics of the .338 Winchester Magnum.

The first member of my .375, .416, and .450 Howell series, the .416 Howell, derived from several big-game hunters' urging that I persuade "the factories" to introduce a good "factory forty" cartridge and rifle. The old Winchester crowd listened to my pleading and asked me to submit a proposal and a design. I drew up a cartridge with about the optimum capacity for a .416, for use in a "standard length" action. I hoped it would approach within a hundred feet per second of the performance that earned the .416 Rigby its reputation as a great Africa cartridge. (It surpasses the .416 Rigby by a hundred feet per second. Yippee!)

The ".416 Winchester Express," though not exactly the way I had designed it, was on its way to becoming the next new Winchester cartridge — for a special new Model 70 Winchester — when the Olin Corporation sold the old Winchester works in New Haven. So I wrote up my .416 as a wildcat, and a hunter-guide in Alaska suggested what I should've thought of myself — that necking it to .375 would make an even better general cartridge for Alaska's big game. Then I realized also that necking the same case out to .458 would improve the .458 Winchester slightly with more-reliable feeding and headspacing. But I didn't realize soon enough that the .404 Jeffery parent case may be too fat for some rifle magazines. So I designed the .375 No. 2 Howell to adapt the first .375 Howell to the inside width of magazines that have trouble with the fatter case.

My .444 Marlin Rimless is an experimental cartridge I used to explore two ideas — headspacing a rimless straight rifle cartridge on the mouth of the case, and using off-the-shelf tools to chamber and load a wildcat cartridge. I call it a "poor man's wildcat" — it uses a standard .30-06 shell holder and .444 Marlin loading dies. I put it on a Mauser action to see what it could do at higher pressures than the .444 Marlin can handle in a lever action, in a barrel with a tighter twist to explore its performance with heavier bullets than the .444 Marlin's.

What do ***you*** want? Why?

All the reasons just discussed are as legitimate for you as they are for anyone else. Establish your own criteria, reasons, and purposes for designing your own cartridge instead of settling for someone else's cartridge. Establish specifically what you want your cartridge to be or to do. Then determine whether any cartridge you can find does what you want your cartridge to do. If none does, there's no reason for anyone to debate or question your decision to design your own. (A few will. Ignore them.)

Purpose and Performance

Your purpose in adopting or designing a cartridge and the performance you want to get from it are your own strictly personal interests. This isn't the place, and I'm certainly not the person to go into what you should look for, how you should try to get it, or any of the whys. They are, as the old disclaimer says, "beyond the scope of this work." You're on your own — and I have the deepest confidence in you. Go to it!

I prefer efficient cartridges to inefficient barrel-burners. Others don't care how erosive their loads are, as long as the velocities, energies, trajectories, and impact of their cartridges satisfy their performance criteria. A gun writer I know doesn't even care that his favorite loads bulge some chambers and limit his cases to a few loadings — they slake his thirst for high numbers on his chronograph tapes. But rather than try to force .35 Whelen performance from a .35 Remington, for example, I'd rather throttle a .358 Norma Magnum back a little.

Some bench-rest shooters appear satisfied with a barrel life of a few hundred rounds (no more than two hundred rounds with one particular cartridge, its designer told me), as long as a barrel delivers those bullets accurately. I'd rather be sure of a few thousand accurate rounds from a barrel, especially in a varmint rifle. I'd rather ooze along with a little less velocity and a lot more barrel life.

Others lean in the opposite direction, toward preferences opposite mine. *De gustibus non disputandum est*, remember?

Can you adopt?

Cartridges are just the opposite of kids, in a way. Most of us prefer to have our own kids and

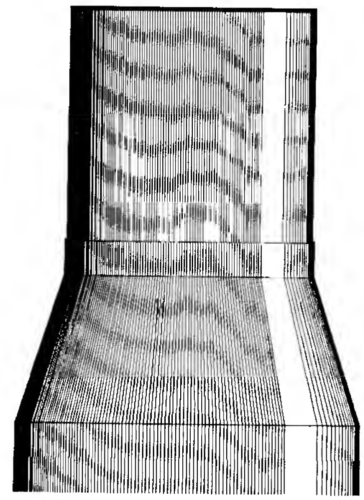
adopt others' cartridges, rather than to adopt others' kids or design our own cartridges. Adopting an already developed cartridge — factory or custom — is generally more practical and economical than starting from scratch to design and develop a new one. So unless some other criterion overrides the value of simple practicality, you're probably better off to look for a cartridge you can adopt.

The variety of choices open to you depends on the crucial dimensions of the action you intend to use as the foundation of a custom rifle, or a gun you already have and would like to rebarrel, rebore, or rechamber. Your best choice may be to chamber your gun for a factory cartridge — even the most ardent wildcatters don't claim that wildcat cartridges are always the best choices for all shooters, all guns, all shooting situations or activities. No universal secret formula automatically determines your best choice — just consider all options.

For brevity and clarity here, I'm not going to strive for any catholic or encyclopedic coverage of all imaginable options and possibilities. For simplicity, I'm going to discuss only one kind of gun-and-cartridge combination. What I say here about rimless or belted necked cartridges in bolt-action or other rifles should indicate at least the kind of thing you should look into for other kinds of firearms and cartridges.

You wouldn't think of trying to stuff a sumo wrestler into a briefcase — but if you don't check and compare all crucial dimensions carefully, you may find yourself trying to cram a sumo cartridge into too small a barrel. One "sumo" misfit is a too-fat cartridge in too small a barrel tenon. The receiver ring may be a massive hunk of steel, but the critical or limiting factor is the barrel tenon — the threaded shank of barrel that screws into the receiver.

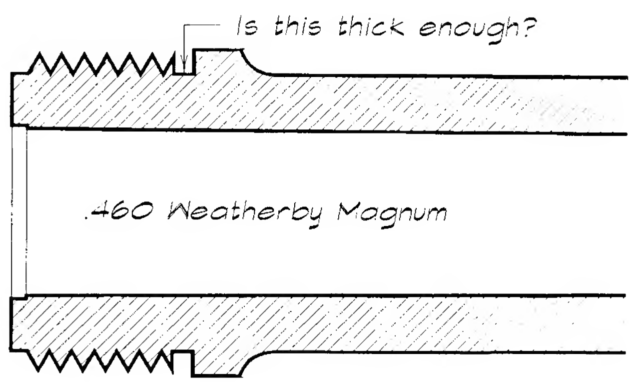
And don't let the diameter of the barrel tenon lure you into complacent satisfaction that there's enough steel to surround any chamber you want to ream out of it. The *smallest* rings of steel around the chamber determine the *largest* safe chamber diameter. The chamber walls are thinnest where the threads are deepest — what gunsmiths and machinists call the minor diameter of the barrel thread — and where there are



Even a logical candidate for rechambering can turn out at least a little wrong. I had a 7x57mm Mauser rechambered to .280 Remington, with this result. The .280 Remington reamer didn't clean up the old military chamber. The larger neck in the original chamber left this belt on the neck of the fired .280 Remington brass. This neck belt shortens the life of a handloader's good brass but is not a problem for the fellow who shoots only factory ammunition.

no threads, between the front edge of the thread and the shoulder of the barrel tenon (below).

The threads inside the receiver ring don't fully or perfectly support the steel below the bottom of the barrel thread, and nothing supports the chamber wall between the barrel thread and the shoulder of the tenon. Reducing the taper of the case body thins the chamber wall and may reduce this ring of steel too much to withstand the maximum peak chamber pressures without bulging the chamber here.



Mauser '98 barrel

Some ultra-light barrel contours save a little weight with a short chamber reinforce (the large-

diameter swell of steel that surrounds the chamber, just ahead of the barrel tenon). The concave taper just ahead of the chamber reinforce may also be very short and abrupt. Especially when the chamber reinforce is also small in diameter, the barrel may be too small to accept a cartridge with a long, fat body.

A rifle manufacturer told me of a friend of his whose rifle had an octagon barrel with no chamber reinforce at all. The limiting dimension of that rifle's chamber was the width of the barrel across the flats, which turned out to be not quite enough steel around the huge chamber. The first round blew out the side of the chamber.

A gunsmith once showed a friend of mine an Arisaka he'd fitted with a super-light barrel chambered for the .308 Winchester. My friend felt uncomfortable with the slimness of the barrel, its short chamber reinforce, and its abrupt sweep to a straight taper, so he compared the barrel and chamber diameters and found that only a thin skin of steel remained around the shoulder of the chamber (at *A* in the drawing below). Reaming that chamber out for a longer, fatter case could have severed the barrel there. The gunsmith was not happy.

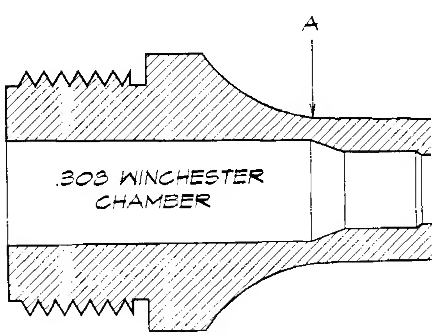
"There's an easy way to double the strength of that chamber wall," my friend said. The gunsmith's face lit up.

"There is? What?"

"Wrap a couple of turns of Scotch tape around it," my mercilessly helpful friend said.

The gunsmith was not amused.

Reboring and rerifling a barrel also calls for careful comparison of significant diameters. The land diameter of the larger bore must be larger than the groove diameter of the original bore — obvious when you think it over. The pilot drill and reamer for the larger bore have to "clean up" the old grooves (cut away all traces of the original grooves) to give the rifling cutter or button a clean new work surface.



The barrel to be rebored may be too small to accommodate the larger bore. At or beyond the minimum legal or acceptable barrel length, the barrel wall should be at least 0.120 inch thick. In other words, the barrel diameter at the eventual muzzle must be 0.240 inch (or more) larger than the groove diameter of the new bore. The thinnest ring of the chamber wall must obviously be substantially thicker, since maximum peak chamber pressure (when the bullet has just begun to move) is much higher than the muzzle pressure (when the bullet exits the muzzle).

Ballistic Efficiency

The ballistic efficiency of a cartridge is a function of its bullet weight, powder charge, and velocity at a specified point along its trajectory (therefore its energy at that point). Anywhere downrange — far beyond the muzzle — the ballistic efficiency of the bullet, expressed as its ballistic coefficient, is also a factor. One of two loads in the same cartridge may therefore be more efficient than the other at the muzzle, and the other load may be more efficient at a hundred or two hundred yards.

The few gun writers who mention cartridge efficiency now and then don't understand what it is, let alone how to calculate it. The methods of comparison I've seen in print show that there's more than a little confusion about this simple concept. A couple of writers' articles show that they've figured out their own useful concepts of ballistic efficiency, but neither is even close to the real thing.

The ballistic efficiency of a cartridge is the kinetic energy *actually produced* by a specific load in a specific cartridge (at a specified range), divided by the *theoretical energy content* of the powder charge, expressed as a percentage.

The math is simple. Here are the basics or "givens" for a typical single-base gunpowder. Its active ingredient, nitrocellulose, has an energy content of about 200 foot-pounds per grain. Inactive ingredients and added coatings reduce the powder's potential energy content per grain. The energy content of the IMR powders, for example, is about 175 to 180 foot-pounds per

grain. (Split the difference — figure 177.5 foot-pounds per grain. Close enough.)

During the load's short active life between primer flash and muzzle blast, several factors use up some of this energy in just getting the bullet under way and pushing it out the muzzle — overcoming the bullet's inertia, swaging the bullet into the rifling, driving it against bore friction, losing the heat absorbed into the barrel steel, *etc*, leaving only — if you're lucky — maybe a quarter to a third of the theoretical energy from the mass and velocity of the moving bullet. Let's compare the muzzle energies of a couple of maximum .338-06 loads in the Nosler manual, third edition, for example.

¤ 53.5 grains of IMR 4320 drove the Nosler 210-grain spitzer partition bullet from the muzzle at 2,690 feet per second, to produce about 3,375 foot-pounds at the muzzle. The theoretical energy content of 53.5 grains of IMR 4320 is about 9,496 foot-pounds (53.5 grains times 177.5 foot-pounds per grain). The actual muzzle energy of the load, 3,375 foot-pounds, divided by 9,496 foot-pounds, is the efficiency of this load: 35.5 percent. This is excellent efficiency.

¤ 56.5 grains of IMR 4350 drove the Nosler 250-grain spitzer partition bullet out the muzzle at 2,410 feet per second, for about 3,225 foot-pounds at the muzzle. The theoretical energy content of 56.5 grains of IMR 4350 is about 10,029 foot-pounds (56.5 grains times 177.5 foot-pounds per grain). The muzzle energy, 3,225 foot-pounds, divided by 10,029 foot-pounds, is the efficiency of this load: 32.2 percent — which is also excellent efficiency.

Bore Capacity

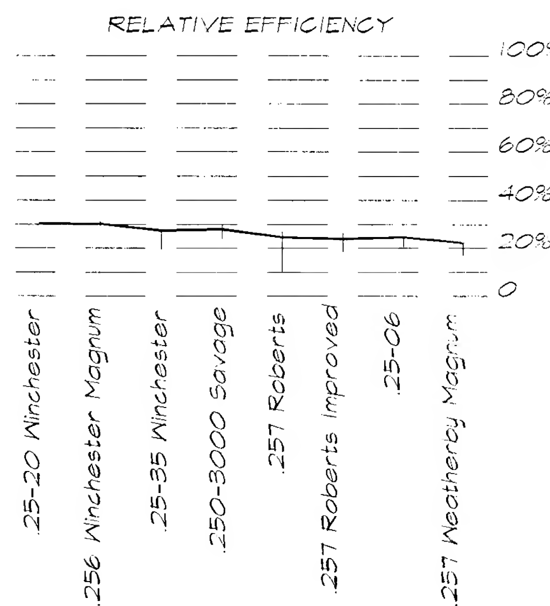
Bore capacity is a loosely understood, undefined standard for comparing or rating cartridge efficiency, a concept too useful to go any longer without a useful definition. Gun literature teems with lines that say this or that cartridge is "over bore capacity," but I've never seen, read, or heard an attempt to define it. So I'm going to stomp out onto thin ice next to a hole over deep water and drum up a definition.

Ackley says in his *Handbook for Shooters and Reloaders*, Volume One, "... an extremely large cartridge holds more powder than the bore can possibly handle efficiently." Starting with this and boiling down all I can remember about bore capacity, I get this basic, working general definition: *bore capacity — the largest powder charge that can produce acceptable ballistic efficiency in a gunbarrel of a given bore size.*

There's one hitch — defining the threshold of acceptable ballistic efficiency. Since no cartridge burns its charge with hundred-percent efficiency — and thirty-percent efficiency is good — how little is too little?

The wee .25-20 Winchester is obviously way below bore capacity for a .25 barrel, and the consensus is that the .257 Weatherby Magnum is way over bore capacity. Within the range of case capacities bracketed by these two .25 cartridges, the .257 Roberts Improved is by consensus "bore capacity." (Some experts consider the .25-06 right smack-dab on bore capacity for a .25 barrel.) So let's look at the relative efficiencies of typical loads in these cartridges — plus the .256 Winchester Magnum, the .25-35 Winchester, the .250 (or .250-3000) Savage, and the .257 Roberts.

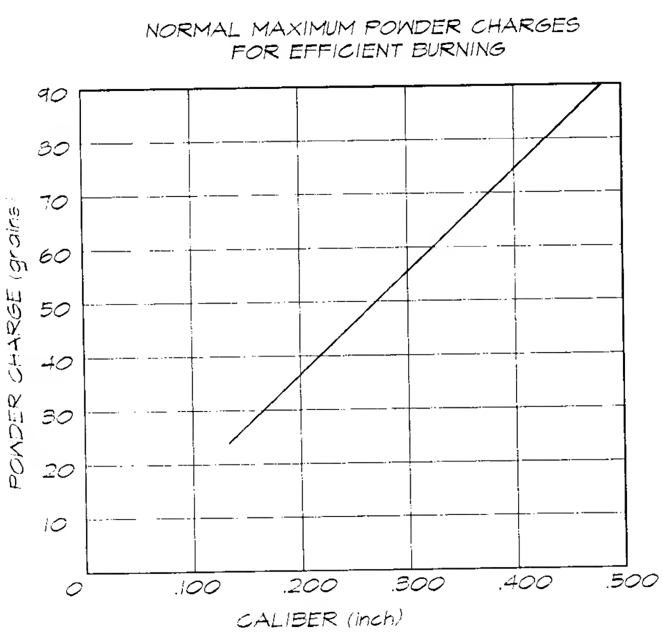
Using loads listed in Volume 1 of the *Hornady Handbook of Cartridge Reloading*, Fourth Edition, I've calculated and plotted the relative efficiencies of these cartridges. In this graph, a short vertical line shows the range of relative



efficiencies for each cartridge, relating actual *muzzle* energies to the theoretical *energy content* of the listed powder charges. The heavy crooked line links the relative efficiencies of these .25 cartridges loaded with the heaviest .25 bullets in the Hornady reloading handbook.

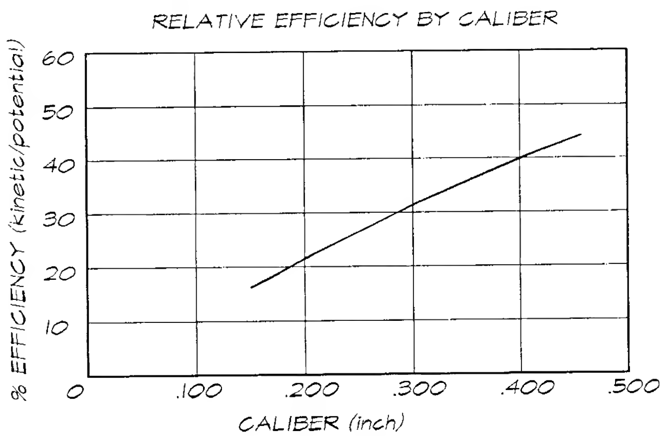
Apparently, about 25% efficiency seems to be the threshold of acceptable efficiency, defining the "bore capacity" of the .25 barrel.

In W-W TB-1, Baker offers another reference for basing a cartridge design on relative efficiency. I don't know how Baker calculated the figures for his graph, but I consider it a useful basic reference. He was the Associate Director of Ammunition Development — so I trust he handled good figures according to sound principles. His graph, which I've redrawn (below), shows a powder charge between 45 and 50 grains as a normal maximum powder charge for efficient burning in a .25 barrel. My efficiency calculations favor a range of about 45 to 60 grains.



Below the graph in his report, his text says, "For example, about 37 grains of powder is the practical maximum charge in Caliber .20, while Caliber .40 can use up to about 74 grains of powder" for efficient burning. In another graph (redrawn below), Baker related empirically derived relative efficiencies to calibers:

If my definition of bore capacity is accurate, then we could label Baker's graph "bore capacities of small-arms barrels." I suspect that trying to define bore capacity with any sharper, finer line of relative efficiency or maximum powder charges would be tantamount to drawing barn rafters to the nearest thousandth or ten-thousandth of an inch.



Barrel Life

The barrel of any firearm wears a little from friction but mostly from heat and pressure, especially when high peak chamber pressures amplify the effects of the heat. Any barrel eventually wears out. Accuracy goes to pot. After so many rounds, a rifle that used to shoot one-inch groups at a hundred yards may refuse to shoot a one-yard group at a hundred inches. *After so many rounds* — how many? Depends on the capacity of the cartridge, its loads, and the number and rapidity of repeated firings.

Gunpowder burns hot enough to burn steel. In slow fire, the heat from the burning powder lasts only a short time — usually not long enough to scorch the bore. But in rapid fire, the heat from one firing doesn't dissipate before the next round adds to it. In the extremely rapid fire of a machinegun, a long string of rapid-fire rounds can burn out a brand-spanking-new barrel in seconds or minutes.

The cartridge itself can exacerbate barrel wear and shorten barrel life. The otherwise impressive .264 Winchester Magnum has earned a sour reputation for rapid barrel wear — short barrel life. Typical loads, particularly those put together by velocity addicts, operate at peak

pressures and heat that burn out barrels more rapidly than most shooters can tolerate. Experimenting with a variety of loads can exhaust the accuracy life of a .264 Winchester Magnum barrel long before the experimenter can develop his best load.

Addiction to high velocity has led many handloaders to cram into each case all the powder their firearms and cartridge brass can hold without sticking cases or bulging chambers. They shorten the life span of their barrels with these maximum or over-maximum loads. Cartridge design can also virtually guarantee short barrel life, as the .264 Winchester Magnum has shown too many disappointed shooters. The biggest case body and the smallest bore are the poorest combination. An ancient joke among modern shooters is the .50 Browning necked to a phonograph needle — which would be the ultimate over-capacity small-bore cartridge. A .50 Browning necked to .22 would be almost as bad. This in *not* merely the extreme model for an undesirable cartridge design. Any design step toward it is a step toward short barrel life.

I know no scientific or mathematical way to define the limits of cartridge design for adequate barrel life — just *avoid the extreme* ratio of case capacity to bore volume. Bore capacity and ballistic efficiency are finer, more admirable gods or goals than high velocity at whatever may be its cost in barrel life.

It's usually good sense to load any cartridge to something less than its maximum pressures and velocities. Ballistician Homer Powley's excellent and wisely designed little "Computer for Handloaders" disappoints shooters who want more velocity. Homer designed that little jewel on the basis of moderate pressures for maximum barrel life. His first pressure basis was, if I remember right, about 45,000 pounds per square inch (psi). A little slippage in the construction of his slide rule modified it a bit — to about 47,500 psi or so. This is still comfortably less than the 50,000 to 60,000 psi typical of many cartridges that have to operate at high pressures to produce the highest velocities.

Any operating pressure above 40,000 psi exposes the barrel to heat higher than the melting point of the barrel steel. The interval from the time the primer lights the powder to the instant the bullet leaves the muzzle is very short, and the instant of peak pressure is much shorter still — not enough time for the powder in one cartridge to provide enough fuel to melt the barrel. But that brief instant of peak pressure is enough time for the powder heat and pressure to leave an infinitesimal effect that with enough firings eventually adds up to noticeable wear. (And finally adds up to ruinous wear.) In the instruction manual for his slide-rule computer, Homer wrote:

"Above 40,000 psi the flame temperature is always in excess of the melting points of all of the ingredients of alloy steels (except carbon) and is the reason for erosion in guns. High pressure is high temperature and, therefore, fast erosion. It is as simple as that. *Barrel life depends upon the pressure*. [The emphasis is Homer's.]

"Barrel life does not depend upon the velocity of the loads as such. If high velocity has been obtained by running high pressures then the cause is still the high pressure and not the velocity. Velocity is always higher near the muzzle where erosion is least.

"Because larger guns burn more powder more heat is evolved per round so large guns at a given pressure will erode or have barrels burn out faster than small volume guns."

Shorter barrel life — what a price to pay for a few more feet per second of velocity!

How to Design a New Cartridge

Cartridge design is really *case* design — usually case *redesign* or modification, unless you're really going to break new ground and design a new type of cartridge or give an old design new base dimensions. Custom cartridges usually begin with an established case. They usually leave the base dimensions the same, but just about anything else (except making the case longer) is grist for the designer's mill.

We can swell case bodies out larger and squeeze them smaller, make them longer, or make them shorter. We can make their shoulder angles shallower or sharper, move them forward or backward, eliminate them from necked cases, and introduce them to straight cases. We can make some case necks smaller and others larger in diameter. We can make some necks longer,

others shorter. Some of our cases become essentially the same length, some just a wee shade longer, some a lot shorter.

We don't redesign the bullets and primers, but a modified case may, in its new form, have to be loaded with a bullet smaller or larger in diameter than it needed in its original form.

Cartridge designers typically think first of their cartridges' intended performance on game, at the range, in the marketplace — but all designs should begin with careful consideration of what they do in chambers (and may do to guns).

Private cartridge designers, if they consider performance at all, typically think only of how they want their cartridges to perform on specific game or at the range. Commercial designers, whose first or only motive may be selling more guns or ammunition, have to consider also what their new cartridges will do inside the chamber before they can put them out for sale.

A careful designer thinks of not only how he wants his cartridge to perform in the chamber but also how it must get from the magazine or from the shooter's hand into the chamber. The finest ballistic performance is impossible if there is no way to get the cartridge into the chamber. Difficult insertion or extraction is almost as bad.

A good cartridge goes easily from the hand or magazine into the chamber, with no interference or hangup along the way. Many fine rifle cartridges that drop easily into the chambers of break-open actions are too long or too straight-sided for some falling-block single-shots and bolt-action magazine rifles. A careful designer wants his cartridge to "feed" easily, so he considers the critical gun dimensions that determine the practical boundaries of safe and practicable cartridge dimensions.

Good sensible fellows who'd never think of mailing a letter in a steamer trunk, nor ever try to cram a sumo wrestler into a briefcase, sometimes appear to forget to put their brains in gear when they go to select or design cartridges for guns they like. But they aren't stupid. What seems to be stupidity is really just a lack of awareness. Most shooters never have any occasion to examine, consider, or understand the dimensions and interlocking relationships that gunsmiths and designers have to keep in mind. So nothing I say here is meant to imply that the fellows who overlook them are dumb or use poor judgment. I mention these things, instead, to urge you to consider them whenever you select or design a cartridge for a specific kind of firearm.

Several critical dimensions determine the range of cartridge dimensions that are possible and practical for any specific firearm. Some of the possible combinations are impractical but may be acceptable to shooters who don't mind the sacrifices they require.

Sometimes, a bolt-action rifle has to be converted from a repeater to a single-shot to accommodate a cartridge that can't fit into or feed from the magazine, for example. Rebarreling a .375 H&H Magnum to the .222 Remington is possible, with a lot of special and extra gunsmithing, but the combination — no matter how fine the rifle is or how well it shoots — is awkward and inefficient. Other cartridge-and-firearm combinations are less obviously clumsy but no less poorly advised.

The length of the action limits the practical length of the cartridges it can handle, and some actions tolerate more length variations than some others. Even a cartridge you can feed into the chamber may be too long to feed into the magazine or from the magazine to the chamber. It's possible to chamber extra-long cartridges into a bolt-action barrel by removing the bolt from the receiver and slipping the cartridge into the chamber by way of the receiver bridge. But this cartridge would be awful clumsy and impractical in any typical hunting situation.

One especially awkward combination I've seen was a cartridge the shooter hand-fed into a bolt-action chamber but couldn't be extracted without withdrawing the bolt from the rear of the receiver. The normal operation of the bolt could extract and eject an empty case but not a loaded cartridge. The rifle was of course no longer a repeater but had become a single-shot, because the cartridge was too long for the magazine.

A top-break single-shot or double can accept long cartridges that would be too long for a bolt-action or a typical falling-block rifle. A long bolt action can of course accommodate short cartridges, but the bolt travel is usually still long enough to be awkward.

The inside length of a bolt-action magazine limits the over-all length of a cartridge a bit more than at first seems obvious. If the cartridge produces noticeable recoil, the magazine has to be long enough to give the cartridge enough fore-and-aft "jiggle room" to avoid battering the bullet tips and bumping the bullets deeper into the cases of rounds still in the magazine (natural results of recoil). The magazine also should be long enough to avoid any need for seating the bullet overly deep to avoid this battering and bump-seating.

The Remington Model 600 and 660 magazines required this excessively deep seating for the .350 Remington Magnum to function — and the base of the bullet jutted back into the body of the case far enough to reduce case capacity significantly. Even this short magnum was too long for the Remington Model 600 and 660 magazine. In a "standard length" magazine — *i e*, long enough to accommodate an 8x57mm Mauser or .30-06 Springfield — the .350 Remington Magnum turned out to be a short, belted, magnum-case equivalent of the .35 Whelen.

The recoil of one or more cartridges can bump the front of the magazine against the tips of the bullets still in the magazine hard enough to mess up soft points or ram the bullets deeper into the case necks. Years ago, my pal Dick Smith watched one of his friends shoot several rounds of .50-110 Winchesters the fellow had loaded with lead bullets and black powder. With the last round still in the magazine, the friend offered Dick the last shot. Dick told me that .50 kicked him worse and was louder than anything he'd ever shot. It stunned him, and he saw tiny spots of nothing exploding in space.

He felt that something was wrong but at first could not think what it was. Then he realized that his left hand still held the forearm and his right hand still held the grip of the stock — and both his arms were hanging straight at his sides. The last round had blown the gun in two at the chamber. The theory developed through *post mayhem* murmuring and muttering was that the heavy recoil of the other rounds had punched the bullet in the last round deeper into the case, and the powder thrust had peened its exposed base over. The reduced powder cavity and increased bullet pull, they figured, had hoisted pressures enough to blow up the rifle.

The inside width of the typical bolt-action box magazine can be crucial in a couple of ways. I've chosen and designed several cartridges with .30-06 bases because the magazines of my Mausers hold more .30-06-base cartridges than magnum-base cartridges. The cartridges I selected and designed gave me ballistics performance comparable to similar cartridges with magnum bases (and the brass cost less to boot).

Reduced magazine capacity isn't the only influence of magazine width on cartridge choice. Cartridges with bases larger than the H&H magnum belted cases sometimes don't feed as easily from the magazine into the chamber.

Typical cartridges for bolt-action rifles, for example, have tapered bodies for a reason. Reducing this taper — making the case body more nearly cylindrical — jeopardizes easy feeding from the magazine to the chamber. The vertical and horizontal distances from the magazine to the chamber establish a necessary angle of insertion that precludes feeding a cylindrical or nearly cylindrical case into the chamber.

The mouth of the chamber, particularly the edge of the chamber opening, is either square-lipped or something of an entrance funnel. A large-bodied cartridge necked way down to a small neck feeds into the chamber more easily than a cartridge with the same case body necked only slightly or not at all.

Some sharp-edged chambers also dislike unnecked cartridges like the .458 Winchester Magnum. On some rounds, the mouth of the case catches on the lip of the chamber and jams some of these rounds. Others lose a little shaving of brass and go on into the chamber after a momentary hitch in the feeding.

I've seen .458 Winchester Magnum bullets ram into the edge of a sharp-edged chamber and stop everything right there. On some rounds, the bullet interfered only slightly — the lip of the chamber scraped a lead shaving off the bullet's nose, and the cartridge then fed into the chamber. But other rounds fed from the magazine at an angle high enough to force the lead tips of the bullets hard against the lip of the chamber. Withdrawn, the jammed rounds all had deep notches

across their lead tips — left by the sharp-edged lip of the chamber.

Even a slight neck and shoulder improve the smoothness of the cartridge's passage from the magazine into the chamber. The extent of the neck-down — the difference between body and neck diameters — affects the ease and smoothness of feeding. A slight step-down from the shoulder diameter to the neck diameter improves feeding. A moderate neck-down improves feeding even more. But an extreme neck-down can introduce another problem, particularly if the shoulder angle is too steep. I've seen extremely necked cartridges with extreme shoulder angles jam when the lower arc of the shoulder refused to cam smoothly and easily past the lower lip of the chamber.

For this and other reasons, good cartridge design favors acute to moderate shoulder angles — 30° or less. The capacity difference between a case with a 40° shoulder and the same case with a 25° shoulder is so slight, I have to wonder why any of us ever messed around with 40° shoulders. Besides, the steepest shoulders encourage telescoping — the steeper shoulders collapse more easily under difficult bullet seating, letting the case neck sink into the body like the head of a scared turtle.

So consider these case features carefully when you select or design a cartridge:

¤ body taper [for best capacity & feeding]

Reducing body taper increases case capacity but may complicate feeding the cartridge from hand or magazine into the chamber.

¤ shoulder angle [for best capacity & feeding]

The best range of shoulder angles is probably 15° to 25° or 30°. First make sure the gentler angle doesn't shorten the neck too much.

¤ neck length [for bullet pull and stability]

The case neck holds the bullet tight for ballistic efficiency, stability, and consistency — and in line with the axis of the bore for accuracy. The neck should be at least long enough to grip the longest or deepest-seated bullet all along its *seated* bearing surface — all the bullet surface that engages the rifling *and is seated inside the neck*. A shorter case neck sacrifices some of the neck's grip on the bullet. A longer neck sacrifices a little powder capacity. A short neck also sacrifices a little powder capacity when the bullet is seated deeper than the length of the neck — when the base of the bullet extends below the bottom of the case neck, it occupies case space that's no longer there for powder to occupy. (Obvious when you think of it, isn't it?)

Consensus favors a minimum neck length equal to one bullet diameter — 0.308 (or 0.31) inch of neck length for a 0.308 bullet, 0.458 (or 0.46) inch for a 0.458 bullet, *etc*. A little longer is better, especially if the cylindrical section of the longest bullet is more than one caliber long.

Drawing and Designing with AutoCAD

AutoCAD isn't the only good software for computer-assisted drafting and design (CAD). It's simply and unarguably the best there is. And it's understandably expensive, since no CAD software with its depth, breadth, and precision can be simple enough to be inexpensive. AutoCAD is to some extent overkill for designing cartridges — this relatively simple use of such a versatile program leaves most of its potential unused. So wouldn't a simpler and therefore less expensive CAD program be a better choice for designing cartridges?

I think not — because AutoCAD, and only AutoCAD, includes several features available in no other CAD program I know of. So ironically, the cartridge designer uses not only the simplest features of AutoCAD but also some of its most erudite and advanced features, while most of its capabilities remain untapped until he decides to use it for drawing or designing other things — anything: a four-leaf express rear sight, a dining-room table, a horse trailer, a split-level house, a hospital, a shopping center, or a Levitt or Del Webb community, for examples.

AutoCAD is powerful, versatile, and impressive — but don't let it overawe you if you want to exploit only part of its potential. (One AutoCAD authority says you can even draw the universe to exact dimension with it, right down to the submicron level. No wonder it doesn't gasp or gulp when it has to do a cartridge drawing.) If a computer hick like me can figure out enough of it to design cartridges with it, anybody else who can use a computer can learn enough of it to do well with it. The secret is to learn only

the features you need, and to avoid trying to learn all of it to use a little of it. You wouldn't expect to take flying lessons in a Boeing 747 to enable you to fly a two-seat Piper J-3 or Cessna 150.

Let's design a cartridge with AutoCAD, beginning with a purely arbitrary premise and no idea how the cartridge will turn out — just to show the procedure. Let's say we want, for who knows what reason or purpose, a .30 cartridge midway between the .30-06 Springfield and the .308 Winchester. Our new cartridge — let's call it the .308-06 Split the Difference — will obviously be longer than the .308 Winchester, so we'll have to use a shortened .30-06 Springfield case. The .308 case isn't long enough.

We start with the head dimensions of the parent .30-06 case. Since rim diameters vary all over the place, miking the rim of a .30-06 case (or even a batch of them) would produce confusing and unreliable specifications. So we start with the SAAMI maximum dimensions for the .30-06 case.

- rim diameter 0.473 in.
- rim thickness 0.049 in.
- extractor-groove diameter 0.409 in.
- extractor-groove width 0.033 in.
- extractor-groove chamfer angle 36°

The next two dimensions we want don't appear on the SAAMI drawing of the .30-06 maximum case, so we have to derive them — the diameter at the base of the body, and the axial distance from the datum line to the junction of the extractor-groove chamfer and the case body. To establish these dimensions, we draw the body of the .30-06 case (to just behind the shoulder) as the SAAMI maximums define it.

- distance to base reference diameter 0.200 in.
- base reference diameter 0.4698 in.
- forward reference distance 1.850 in.
- forward reference diameter 0.4426 in.

We start our drawing at the basic reference point for locating AutoCAD lines, point *0,0* in line-graph terminology. The first zero means this point is the left reference point for distances measured to the right (*along the x axis*, in line-graph lingo). The second zero means this point is the low reference point for distances measured upward (*along the y axis*, in line-graph lingo).

Beginning at the 0,0 point, we draw first only half the longitudinal profile of the case head and basic body. (After we've drawn the profile of the new wildcat cartridge, we'll flip it over the long axis with AutoCAD's *mirror* command, to double it into the full outline of the cartridge — so don't worry about working with only half an outline for a while.)

The moderately tricky point to keep in mind is that since we're drawing only half an outline, we're drawing with only half of each specified diameter — the radius of each diameter — but the *full length* of each horizontal dimension.

We can draw our profile with a series of connected lines, using AutoCAD's *line* command, but those lines would complicate the rest of the procedure — so we use instead the *pline* command. In AutoCAD's shorthand, *pline* (pronounced *P-line*, rhymes with *feline*) stands for *polyline* — a single line that comprises a number of connected segments. AutoCAD responds to the *pline* command by asking for the *x,y* coordinates where the polyline is to begin. The first segment of our profile polyline goes from *0,0* to the next defining point, the rear edge of the rim. Using the radius — half the diameter — of the rim, we enter *0,.2365* (0.473 inch divided by 2 equals 0.2365 inch), and AutoCAD asks for the *x,y* coordinates of the next point — the forward edge of the rim. So we enter the full rim thickness (0.049 inch) and half the rim diameter — *.049, .2365* — and AutoCAD asks for the coordinates of the next defining point — the rear bottom of the extractor groove.

The diameter of the case at the bottom of the extractor groove is 0.409 inch, and we want the radius at this point — 0.2045 inch. So we enter *.049,.2045*, and AutoCAD draws the next segment of the line, from the front edge of the rim to the rear bottom of the extractor groove. Now we have to give AutoCAD a different answer to its prompting for the next defining point. Instead of typing in the *x,y* coordinates for the next point, we can have AutoCAD draw the bottom of the extractor groove (0.033 inch wide) by entering the length and angle of the line. The entry *@.033<0* tells AutoCAD to draw a horizontal line 0.033 inch long, toward the right (in AutoCAD, 0° is toward the right, and angles increase counter-clockwise from the horizontal).

Now we want to draw the chamfered front edge of the extractor groove, but the SAAMI drawing doesn't specify the axial distance or the diameter at the forward edge of the extractor-groove chamfer, so we have to derive it from the dimensions SAAMI gives us.

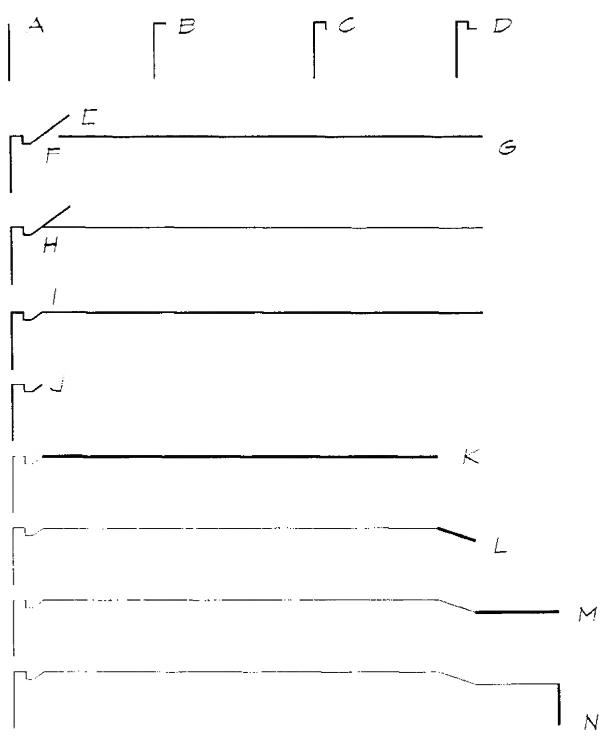
The angle of the extractor groove's chamfered front edge is 36°, so we enter *@.2<36*, and AutoCAD draws a 0.2-inch line that angles 36° above horizontal. (The length 0.2 inch is arbitrary — intentionally chosen almost randomly to be sure this line is longer than it will finally be.) We end this polyline here and ignore AutoCAD's prompt for the next coordinates by tapping the *Enter* key twice. AutoCAD asks for the *x,y* coordinates for the beginning of the next polyline — the line that defines the taper of the case body.

¤ distance to the base reference diameter 0.200 in.
¤ base reference diameter 0.4698 in.
¤ forward reference distance 1.850 in.
¤ forward reference diameter 0.4426 in.

So we enter first *.2,.2349*, then *1.85,.2213* to draw this second polyline. But we want *one* clean polyline that represents the profile of the .30-06 head and base. Good ol' AutoCAD has a slick function called *extend*, which extends a specified line in the specified direction to join another specified line. After we extend the body line (in a minute) to the chamfer line, we'll use another slick AutoCAD function — *trim* — to clip the overlong chamfer line back to where it joins the extended body line.

Enter *extend*, and the AutoCAD cursor becomes a tiny pickbox to select first the goal line (the extractor-groove chamfer), then the line to extend (the body-taper line). The body-taper line lengthens to the left and stops at the chamfer line.

Now we clip off the excess chamfer line by typing *trim* and selecting (with the same little pickbox cursor) first the body-taper line, then the excess portion of the chamfer line. The chamfer line shortens to where it meets the body-taper line. We erase the body-taper line. Now we have just the basic .30-06 head, from which we'll extend the next polyline to define the preliminary design dimensions of our new cartridge.



A. 0,0 and 0,.2365 draw the .30-06 head line.
B. .049,.2365 draws the edge of the rim.
C. .049,.2045 draws the rear edge of the extractor groove.
D. @.033<0 draws the bottom of the groove.
E. @.2<36 draws the chamfer line.
F. .2,.2349 begins the .30-06 body taper.
G. 1.85,.2213 draws the body taper.
H. EXTEND extends the chamfer line.
I. TRIM clips the excess body chamfer line.
J. ERASE removes the .30-06 body line.
K. OSNAP & 1.7539,.22375 draw the .308-06 body.
L. 1.9101,.1708 draws the shoulder line.
M. 2.2545,.1708 draws the neck line.
N. 2.2545,0 draws the mouth line.

DRAWING THE ROUGH .308-06 SPLIT THE DIFFERENCE

Now let's derive the shoulder distance and diameter, the neck distance and diameter, the case length, and the mouth diameter for the rough first dimensions of our wildcat .308-06 Split the Difference.

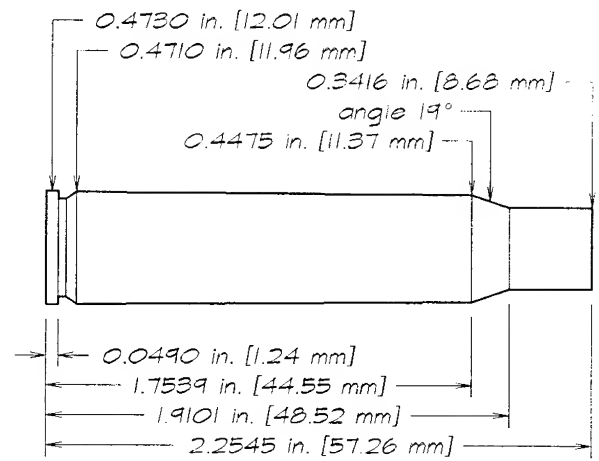
¤ shoulder distance
  .308 Winchester 1.5598 in.
  .30-06 Springfield 1.948 in.
  split the difference, 1.7539 in.
¤ shoulder diameter
  .308 Winchester 0.454 in.
  .30-06 Springfield 0.441 in.
  split the difference, 0.4475
  (radius 0.22375 in.)
¤ neck distance
  .308 Winchester 1.7116 in.
  .30-06 Springfield 2.1086 in.
  split the difference, 1.9101 in.
¤ neck diameter
  .308 Winchester 0.3435 in.
  .30-06 Springfield 0.3397 in.
  split the difference, 0.3416 in.
  (radius 0.1708 in.)
¤ case length
  .308 Winchester 2.015 in.
  .30-06 Springfield 2.494 in.
  split the difference, 2.2545 in.
¤ mouth diameter
  .308 Winchester 0.3435 in.
  .30-06 Springfield, 0.3397 in.
  split the difference, 0.3416 in.
  (radius 0.1708 in.)

Now we draw the rest of our rough design profile to these first specs, starting our next polyline at the upper end of the extractor-groove chamfer. At the *pline* command, AutoCAD asks first for the beginning point, then the next defining point — and so on — to define the profile of the body, shoulder, and neck.

1.7539,.22375 forms the body line.
1.9101,.1708 forms the shoulder line.
2.2545,.1708 forms the neck line.
2.2545,0 forms the mouth line.

Now, with the *mirror* command, AutoCAD flip-copies the profile to form the full outline of the new cartridge — ready for drawing-in the dimension lines. AutoCAD obediently derives the shoulder angle — 19° — not a very steep shoulder. Now we subtract the body-and-shoulder length (1.9101 inch) from the case length (2.2545 inch) to get the neck length — 0.3444 inch, more than enough neck for a .308 bullet.

.308-06 Split the Difference (rough)



The trouble is, our rough first design of the .308-06 Split the Difference gives us lengths and diameters out to four decimal places. A refinement of this design would specify lengths and diameters to the nearest thousandth of an inch.

So let's refine this rough design by specifying slightly different dimensions for the key lengths and diameters. (There's no magical value in specifying key defining dimensions out to four decimal places. Secondary or derivative dimensions are a different matter altogether. We have to let them be whatever the defining points line them up to be.)

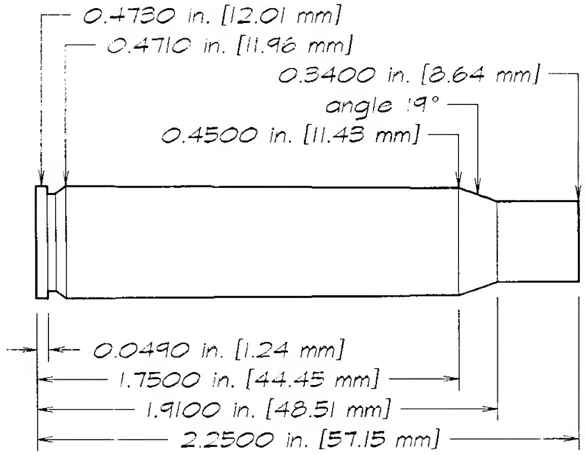
Let's round them off to the nearest hundredth of an inch and see what we get.

¤ shoulder distance ~~1.7539~~ 1.75 in.
¤ shoulder diameter ~~0.4475~~ 0.45 in.
¤ neck distance ~~1.9101~~ 1.91 in.
¤ neck and mouth diameter ~~0.3416~~ 0.34 in.
¤ case length ~~2.2545~~ 2.25 in.

Following the same procedure for drawing onto the basic .30-06 head drawing, I got the refined version of the .308-06 Split the Difference at the top of the next page. The shoulder angle is still 19°, and the neck is 0.34 inch long (about right for a .308 bullet).

But a good many excellent lever-action and single-shot rifles don't cotton to rimless cartridges. Adapting the extractors for rimmed cases to work equally well with rimless cases is at best

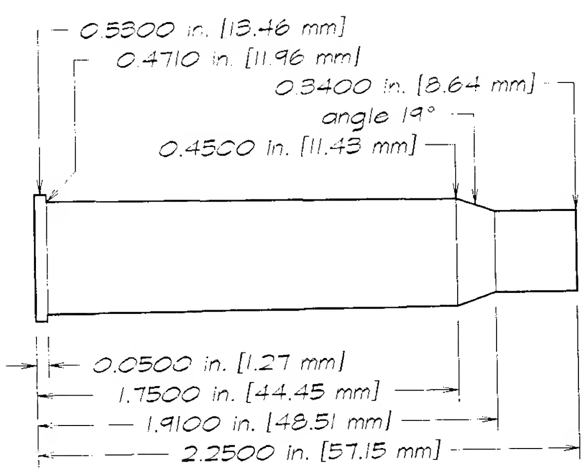
.308-06 Split the Difference



difficult, at worst practically impossible. So for the shooter who'd love to chamber a single-shot or lever-action rifle (or silhouette pistol) for a rimmed .308-06 SD, let's put a rim on our new wildcat cartridge.

The .400 Nitro Express Basic and .400-.350 Nitro Express brass, once again available, have finally made it easy to put rims on cartridges based on the .30-06 Springfield and essentially similar cases. So we can just draw the head and base of the .400-.350 NE, and draw onto it the body, shoulder, and neck of our rimless .308-06 SD, and we've quickly and easily "designed" the .308-06 Split the Difference, Rimmed (or .308 SDR, for short).

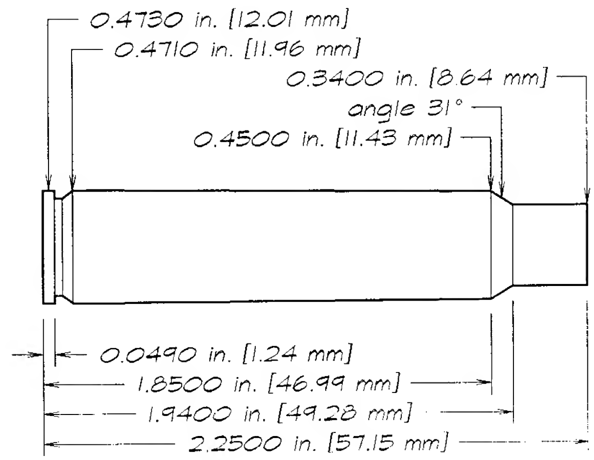
.308-06 Split the Difference, Rimmed



For the shooter who wants an "improved" version, let's give our .308-06 Split the Difference a minimum neck (one caliber long) and a 30° shoulder (angling back and up from the rear of a 0.31-inch-long neck).

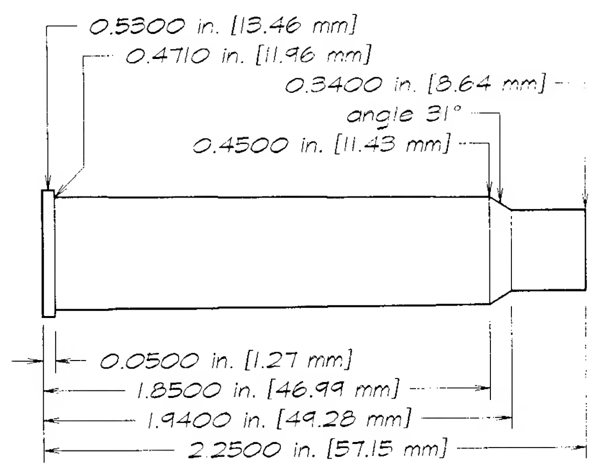
Again, we get a nice-looking case, but the shoulder distance is 1.8458 inch, and the shoulder diameter is 0.4488 inch — two awkward numbers, so let's round them off to 1.85 inch and 0.45 inch, and see what new shoulder angle we get from these new defining numbers.

.308-06 Split the Difference, Improved



Now we have a good-looking case with numbers easy to read and to set on measuring tools. The new shoulder angle, according to AutoCAD, is 31° — not far from our first 30° shoulder, and not a wild, hard-to-read or hard-to-

.308-06 Split the Difference, Improved, Rimmed



set angle. A rimmed version of our .308 SDI is as quick and easy to "design" as the first rimmed version we just finished.

This cartridge looks so good in all its forms, I wish I'd thought of it as a serious design instead of an intentionally frivolous subject for a serious exercise. Now I wonder how close its performance would approach the .30-06 Springfield's — and whether and how much it would exceed the performance of .308 Winchester. The rimmed versions would have to be loaded to lower peak pressures, for the weaker lever and single-shot actions that almost demand rimmed cartridges.

Case and Headspace Dimensions

AutoCAD makes the usually laborious task of adding dimension lines and text to your cartridge drawing almost absurdly simple. I won't go further into this part of the drawing — which AutoCAD's superb manual explains with exceptional clarity — except to ask you not to ape my copyrighted format, including its layout, arrowheads (which I designed and drew), and lettering.

Next, you'll want to establish the forward contact point for headspacing your cartridge. On a rimmed or belted case, the forward edge of the rim or belt is traditionally the forward contact point for headspacing the cartridge. If your belted or rimmed cartridge is necked, you'll find that headspacing on the shoulder — usually halfway down the slope of the shoulder, sometimes at the junction of the shoulder and neck — is a far more reliable headspace reference or datum.

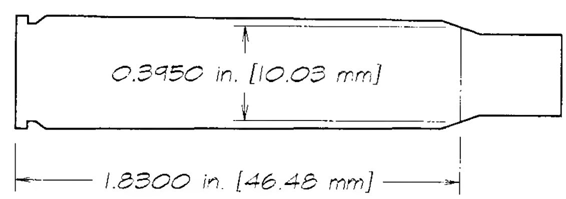
The obligatory small radius that rounds the junction of the neck and shoulder complicates (a little) determining the case diameter at the headspace point and the axial length from the center of the head to the center of the case at the headspace point. So it's easier to establish the headspace reference or datum exactly halfway along the shoulder line.

The ancient Greeks had a word for everything, and AutoCAD not surprisingly seems to have a way to do anything, including a neat special function that eliminates all the fuss of figuring out the headspace dimensions mathematically. The *object snap* function (*osnap* in AutoCAD slang) includes the option *mid*, which enables AutoCAD to snap onto the exact middle of the line or line segment you select with the little pickbox cursor that always appears on the screen just when you need it (and sometimes when you don't, if you're as clumsy as I am).

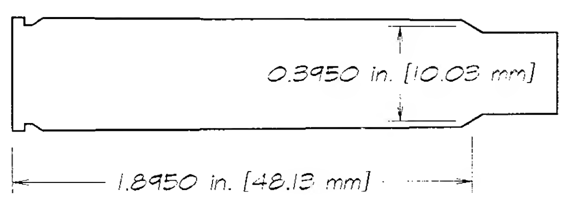
If you've drawn your cartridge exactly to specs — not freehand — draw one line from the middle of the upper shoulder line to the middle of the lower shoulder line. Type *osnap* again and select the *int* option (for *intersection*).

Draw in the dimension line for the horizontal distance from the rear edge of the rim to the intersecting lines at the middle of the shoulder, and you have the nominal horizontal headspace dimension for the case.

Draw in the dimension line for the vertical distance from the middle of the lower shoulder line to the middle of the upper shoulder line, and you have the diameter of the case at the middle of the shoulder slope — the nominal diameter headspace dimension for the case.



REFERENCE LENGTH AND DIAMETER FOR HEADSPACING THE .308-06 SD ON THE MIDDLE OF THE SHOULDER



REFERENCE LENGTH AND DIAMETER FOR HEADSPACING THE .308-06 SDI ON THE MIDDLE OF THE SHOULDER

Now you have the basic information, on good clear, dimensioned drawings, to give the gunsmith who will chamber or rechamber your barrel. Or, if you order your own reamers and headspace gauges, you have the basic information your reamer-maker and loading-die maker need to determine their chamber, reamer, and headspace-gauge dimensions.

With a few easy AutoCAD moves, we find that the reference length and diameter for headspacing the .308-06 SD on the middle of the shoulder are 1.830 inch and 0.395 inch. The same few moves on the .308-06 SDI drawing tell us that the reference headspace length for the "improved" version is a bit longer at 1.895 inch, but the reference diameter (0.395 inch) is the same for both the original and the "improved" versions of our rimless .308-06 SD.

Traditionally, the reference headspace figures for the rimmed versions are the diameter and thickness of the rim. But headspacing on the shoulder is more reliable, so it's nice to note that the same headspace references apply to both the rimless and rimmed versions of each cartridge.

The reference dimensions for the .308-06 Split the Difference (rimless) also apply to the rimmed version.

The reference dimensions for the .308-06 Split the Difference, Improved (rimless) also apply to the rimmed version.

If you don't have, don't want, and won't get close to AutoCAD but want to design a new cartridge precisely with its help, get in touch — and let's see whether between us, we can't get you on your way to making your new cartridge a reality. As long as the demand doesn't grow beyond what I can handle, I'll help everyone who asks me to lend a hand with a new cartridge.

Chapter 6

Let's get down to cases.

ENOUGH PREAMBLE. Let's get down to cases. (Yes, I know that cases aren't cartridges — but cartridge designs as basic dimension references have to be *case* designs, since bullet designs and primer dimensions don't affect basic cartridge design and dimensions and therefore aren't relevant here. So in this chapter, *case* is functionally synonymous with *cartridge*, despite their technical distinction.)

Taxonomy

"User-testing" this collection of cartridge-design drawings in several venues (at several gun shows, for example) has revealed how typical users handle the format and arrangement of these drawings. Each four or five users have had five or six opinions about how to arrange all these cartridge drawings:

- by caliber and metric designations
- by American and foreign designs
- by military and sporting classification
- by rifle and handgun application
- by case type
- by bullet diameter
- by relative power
- in chronological order
- current and obsolete

From the first, I've considered and studied every arrangement I could think of, plus every arrangement others suggested. The arrangement you see here turns out to be the most logical and the easiest to use, and it presents the least confusion, once you see the logic of it. Every other arrangement is in some way confusing, especially to users who aren't cartridge enthusiasts or experts. Not every reader knows whether a given cartridge is for a handgun or a rifle. Arranging the drawings by case type is confusing and useless for the same reason. Not everyone knows whether a given cartridge is rimmed, rimless, belted, or semirimmed — or whether it's necked or straight — until he looks it up.

I've always used the leading decimal that SAAMI illogically omits from caliber designations (I use *.357 Magnum* and *.22 Hornet*, for example, not *357 Magnum* or *22 Hornet*). I have simply listed and arranged these drawings in numerical order. Cartridges with decimal caliber designations automatically come before those with metric designations — since numbers that start with a decimal are automatically less than whole numbers — so the larger and more powerful .577 Nitro Express appears long before the milder and smaller 5.6x35mm Rimmed. Case size, bullet diameter, and cartridge power don't govern arrangement here. Keep this simple plan in mind, and you won't expect to find the 6mm Remington in the vicinity of the .243 Winchester, for example, or the .280 Remington between the 7x57mm Mauser and the 7mm Rem-

ington Magnum.

Also, the decimal means something and thus conveys a useful bit of information. Besides, it's how the names of cartridges appeared in print when I started reading about them. On all the oldest official cartridge drawings I have, the cartridge designations include the decimal. I have a sheaf of old Winchester factory drawings dated 1911, 1912, and 1913 and a sheaf of Kynoch drawings with dates that range from 1884 to 1959 — all with the decimal. The decimal also begins the caliber designations in a factory table of chamber dimensions from the Charles Newton and Buffalo Newton rifle companies, on a 1975 Remington drawing, on 1981 and 1982 Weatherby drawings, and even on the original 1938 SAAMI drawing of the .40-82 Winchester.

With so honorable and well established a precedent for using the decimal, I see no reason to change simply because somewhere along the line SAAMI decided to drop it — especially when leaving it off strikes me as essentially identical to old Colonel McCormick's ill-fated plan to use his newspaper to reform the spelling of simple English words.

Like most other sensible folk, I never took up the colonel's "improved" spellings of our ordinary words (*lite, nite, tho, thru, thoro*), and I see no better reason to drop the mathematically correct, inoffensive, unobtrusive, useful decimal in cartridge names. The only "reasons" anyone has ever given me for omitting the decimal are "That's the way SAAMI does it" and "Those are names, and you don't put a decimal in front of your name."

Even ignoring the fact that my name does not begin with a decimal number less than 1.0, that's still not enough to persuade me. In this matter of the leading decimal, I'm like the old fellow out for a drive with his wife.

"Honey," the old lady said, "remember how we used to go for a drive when we were courting, and when we were just married?"

"Yes, dear, I remember."

"Remember how we used to sit? I'd sit right next to you, and you'd put your arm around me and hold me close to you. Remember?"

"I haven't moved."

I haven't either. The leading decimal is older than the omission of it. I haven't quit using it simply because others have.

I'm not alone. It's just good sense and practical to use it. Even SAAMI still uses it in metric designations (it's *6.5x55mm Swedish Mauser*, for example — not *65x55mm*), tacitly conceding the mathematical correctness of the decimal. Except for those with metric designations, SAAMI cartridges that began as wildcats began with decimals in front of their numbers. I don't know why SAAMI chose to drop those decimals, but their reasons — however logical they may be to SAAMI — don't establish universal usage.

The many non-SAAMI cartridge designations that include the decimal far outnumber the few SAAMI cartridges that omit it. Consistency favors cleaving to majority usage, whatever degree of usage authority others may attribute to SAAMI. Consistency can't tolerate mixing the relatively few drop-the-decimal cartridge designations among the far more numerous use-the-decimal designations. No logic that I can imagine would favor dropping the decimal from all those many other designations just to make them conform to the fewer SAAMI designations.

Whether you use the decimal is up to you — but you will need it to find some of the cartridge drawings in this collection.

In arranging the order of these drawings, another worrisome question was how to arrange the complex designations — where to put, for example, the .30 Carbine, .30 Newton, and .30 Remington in relation to the .30-06 Springfield, the .30-.338, and the .30-40 Krag. Remember, first, that the bullet diameter and the relative size or power of a cartridge have nothing to do with where it appears in relation to another cartridge.

Only the numbers matter.

Study the list of cartridge drawings, and you'll see that the simpler designations precede the more complex designations — the .25 Automatic and .25 Remington, for example, then the .25-20, .25-.222, and .25-35. The .25s come before the .250s, which of course come before the .257s.

Within this basic numerical order, letter designations appear in alphabetical order — for example, among the .257 labels again, the order is .257 <u>K</u>imber, .257 <u>M</u>agnum Revolver, .257

Roberts, .257 Sabrecat, .257 Ugalde, and .257 Weatherby Magnum. But no system or principle governs cartridge designations, so any neat taxonomic order omits exceptions. In these drawings, the 2-R Lovell lies between the .17s and the .21s — and the Super 10mm Magnum appears where it would be if it were the *10mm Super Magnum.*

Spend a little time cruising the index, and you'll get the hang of the layout without any trouble. The drawings appear in the same order as they're listed in the index. If you have no trouble with the order of the index, you'll have no trouble with the arrangement of the drawings in this chapter.

Scale and Format

Each cartridge drawing in this collection is half again as large as the cartridge it depicts. One-to-one drawings would've been big enough for the medium and huge cartridges but too small for wee ones like the .25 Automatic. Two-to-one drawings would've been great for the .25 Auto and the 4x27mm CETME but would've run the .50 Browning and the .650 Gatling past the edge of the page.

Showing some cartridges at one scale and others at another scale would've been inconsistent and confusing, so I've never considered anything except one scale that would be adequate for all drawings. A single consistent scale is mandatory for maximum usefulness. The scale of 1.5 to 1 (1.5x) accommodates the entire range of sporting cartridges to this page size.

Consistency is great for reducing confusion and encouraging easy comparison, so consistency has been a fixed goal of the International Cartridge Archives projects from the outset. This book may have been useful enough if I'd simply reproduced the drawings, tables, and specifications I've used as sources. But no two sources have used the same format and therefore are awfully hard to consult for direct comparisons. Many are cussedly hard to read.

Some authorities haven't used a consistent format for their drawings. The sources I've used don't list the same dimensions in comparable drawings, and they don't show dimensions in the same way.

Some give shoulder angles relative to the longitudinal axis of the case. Others give the angle from shoulder to shoulder (twice the angle between shoulder and axis). Many don't give shoulder angles at all. Some show all length dimensions the way I do: from one datum line at the breech. Others string them out: rim thickness, rim to shoulder, length of shoulder, length of neck. Some layouts range from weird to screwy.

Most amateur drawings are sketches, not drawn to scale, that only roughly approximate the lines of their cartridges. Some of these personal drawings are moderately accurate free-hand sketches of bodies, shoulders, and necks with no pretense of accuracy in the outlines of the rim, extractor groove, belt, or base. I draw all the outer features of each case to the exact dimensions either shown on the cited source drawing or derived precisely from the dimensions on the source drawing.

When I draw cases from amateur designers' sketches, I use the the appropriate SAAMI maximums or equivalent dimensions for the rims, grooves, belts, and bases of the parent cases.

The obsession for logical, useful consistency led to the format of my drawings, which have often required interim work with a couple of scientific calculators — converting millimeters to inches, deriving shoulder angles, adding or subtracting length dimensions given in other forms to get the dimensions shown, and so on. Many of the sources I've used omit dimensions that you and I consider vital, and many include dimensions that are useless for our purposes. And they are often cluttered and hard to read, even when the copies I have are clean and clear. Many are too unclear to reproduce directly.

Cartridge Designations

The name or designation of each cartridge in the upper left corner of the drawing is usually the more or less official name on the drawing where I got the dimensions. Other names for the same cartridge may be more familiar to many readers, but I've made no effort to list these other names. An awful list of cartridges, for example, are well known to Americans and Europeans by separate names that bear no resemblance one to the other (*e g*: .22 Hornet and 5.6 x 35mm Rimmed, .308 Winchester and 7.62mm NATO).

Some strictly American cartridges have an alias, too. The .30 WCF is the .30-30 Winchester — old name, same thing. The .38-40 and .44-40 Winchester used to be known as the .38 WCF and .44 WCF.

Tracking down and listing all the aliases for any number of cartridges is an impossible job that I've given no time at all. These aliases are too numerous, too varied, and too often erroneous to be useful in a crisply precise reference. There's already too much confusion about which cartridges are "the same as" others.

Some cartridges appear in this chapter more than once, because they have shown up under alternate names and usually with slightly variant specifications, from different specifying authorities. Others appear twice — and at least one appears three times — under the same names, with the slightly different dimensions specified by different authorities.

I've noted one erroneous alternate designation, however, that in popular use threatens to usurp the correct name — the .45 Colt is *not* and never was the .45 "Long" Colt. There never was a .45 Short Colt to make it necessary to use "Long" to distinguish its bigger brother. There were Long and Short Colts in other calibers — .32s and .38s — but not .45s. The misnomer .45 "Long" Colt appears in at least one handloading manual, but it's still as wrong as the junk-mail address labels that list my name as Ken Howall, Ken Howe, Ken Howl, Keith Howell, and Kim Howell. I'm still just and only Ken Howell, and the .45 Colt is still just and only the .45 Colt.

As you prospect or cruise these drawings, you'll see from their dimensions which cartridges with different designations are essentially or exactly the same. Also, since any one cartridge with more than one designation may be known to a reader by only one name or another, these drawings include several cartridges under two or more designations.

This collection also includes several other intentional duplications — drawings with dimensions from more than one dependable source — to show how equally dependable authorities sometimes list exactly the same dimensions for one cartridge and at other times list slightly different dimensions for the same cartridge with the same or a similar designation.

Sources and Reliability of Data

To make these drawings, I've had to rely on sources with a wide range of reliability. To give due credit and to indicate the reliability of the data I've used in making my drawings, I've listed the source of the dimension data in parentheses at the upper right of each drawing. The reliability of most sources is automatically obvious. Others are less reliable but generally creditable. I've used several very good and reliable drawings that for one reason or another I've had to list as "unidentified." These lie close to a line I don't want to cross — the line between dependable data and what I call hearsay dimensions. Cartridge drawings based on hearsay passed along without documentation, on unnoted dimensions, and on measurements taken from specimen cartridges and fired cases lead to confusion, inaccuracy, and disputes even when the actual differences in dimensions are slight and meaningless.

There's no disputing the authenticity or the authority of the SAAMI, Triebel, and CIP maximums or the Eley, Kynoch, Norma, Remington, and Winchester drawings, of course. Cartridge designers' specifications for their own cartridges are equally beyond question.

I have used some unidentified drawings because they have the flavor of authenticity, and I've used several of Dave LeGate's drawings because I knew of his generally diligent work. The drawings I've based on these less-reliable sources are correspondingly less reliable than drawings I've based on impeccable, unimpeachable authorities. Dimensions from quasi-reliable sources are therefore *interim* data. I want all the dependable source data I can get for these interim drawings — and when I get better data, I'll redraw them to make them absolutely reliable.

Under some of my drawings of Charles Newton's cartridges — see the .40 Newton, for example — you'll see that I've derived case dimensions from the Newton factories' table of chamber dimensions. Consider these as approximate, not authoritative. Newton's table lists his chamber dimensions for the .30-06 Springfield. I compared these with the SAAMI maximums for the .30-06 case and then applied the same

clearances to derive an approximation of his case dimensions from his chamber dimensions.

I've listed the dates of the source drawings I've used for some of my drawings but not for all. Undated SAAMI maximums are current. Dated SAAMI maximums are for cartridges no longer made by any of SAAMI's member companies. Some of my source drawings list no date.

I have included the dates of some of my source drawings because their age makes them somewhat interesting, but the dates of other original drawings seem irrelevant.

The note "designer's specs" on any of my drawings of wildcat cartridges refers to the dimensions that *a* designer (not necessarily *the* designer) has specified for his conception of that particular cartridge. The designer whose specs I've used may not be the only one who has designed that cartridge.

Other designers may have independently come up with the same, nearly the same, or significantly different dimensions in adapting that parent case to bullets of that diameter. I've found several instances of the same cartridge name or designation used for necked cartridges with slightly or significantly different

shoulder distances, diameters, or angles
neck distances and diameters
case lengths

and even different parent cases. (Shoulder and neck "distances" are the horizontal lengths from the datum line at the breech to the junctions of (a) the body and the shoulder and (b) the shoulder and the neck.)

I'm sure my 6.5mm-.308, for example, isn't the first or only .308 Winchester necked-down for 6.5mm bullets. I know of no other — which is why I had to work out dimensions for this one when a friend asked for it. If I'd had dimensions for anyone else's 6.5mm-.308, I would've sent him a drawing derived from those dimensions.

Case Dimensions

Depending on the origins of the data I've used to make these drawings, the dimensions in some of my drawings are specified *maximums*. The dimensions in other drawings may be either maximums or *specifications*. The authorities that specify the industry standards for manufacturing ammunition and components — SAAMI, the Birmingham Proof House, Triebel, CIP — set down maximums for cartridges and corresponding *minimums* for chambers.

Some designers' and manufacturers' cartridge drawings don't specify whether their dimensions are maximums or specifications. A few designers and most manufacturers specify maximums; the others' dimensions are probably specifications that allow for tolerances.

Maximums — the dimensions of actual cartridges can't be any greater than these.

Minimums — the dimensions of actual chambers can't be any any smaller than these.

Specifications — the dimensions of actual cartridges can be more or less than these, within certain defined limits (tolerances).

So far, I haven't drawn cartridge drawings from reamer dimensions, which I assume are some undefined amount larger than chamber minimums to allow the reamers to be used several times before repeated sharpenings reduce the reamer diameters below the specified minimum chamber diameters.

I wish the world of cartridge dimensions were all of the same cloth, so a single reference like this could give you completely comparable dimensions for all listed cartridges. But this ideal can never be a reality. The fact that other cartridge references list incomplete dimensions from unknown origins reflects the difficulty of compiling even the hodge-podge of source material for the dimensions in my drawings.

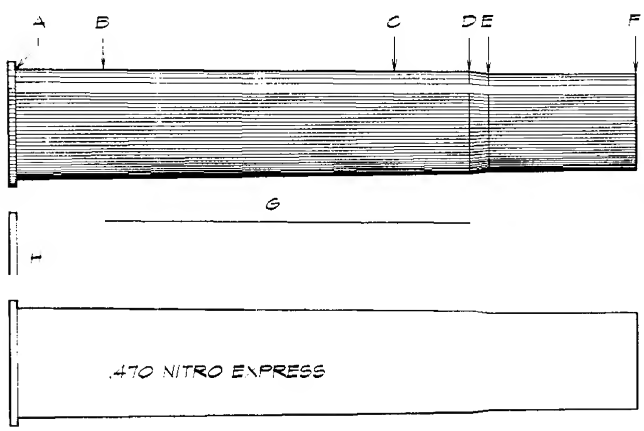
Most of the drawings I've used as sources show other dimensions that I don't include in my drawings. My drawings are *not* meant to be used to make tooling or to make cases from scratch. They're references for shooters, handloaders, designers, collectors, researchers, investigators, historians, not manufacturers — though I'm sure some manufacturers will find them useful, too.

Most people who use my drawings aren't likely to want or need the internal dimensions of cases, nor any of the external dimensions I've left off my drawings for clarity.

Manufacturers and toolmakers use dimensions that you and I have little use for and may find virtually impossible to measure. SAAMI's drawings, for example, don't show the diameter

of the base at the leading edge of the chamfer (the slope ahead of the extractor groove) on a rimless case. Instead, the SAAMI drawings give the diameter of the base 0.200 inch ahead of the datum line (0.250 inch on the .470 Nitro Express). But to you and me, this diameter lies somewhere between useless and meaningless. We can't measure it as easily as precisely as we can measure the diameter at the leading edge of the chamfer.

AutoCAD comes to the rescue. I draw the rim and extractor groove to SAAMI's dimensions, then draw the chamfer at the specified angle but long enough to jut out well beyond the diameter of the base. Then I draw the body, from the reference point 0.200 inch ahead of the datum line to a forward reference point on the SAAMI drawing — usually, the intersection of the body line and the shoulder line. Then, with AutoCAD's "extend" command, I extend the body line backward to the chamfer line — then with the "trim" command, I trim off the excess chamfer line. AutoCAD's extreme internal precision locates this intersection with more accuracy than anyone needs. The diameter here is always a bit



SAAMI's drawing doesn't show the diameter of a maximum .470 Nitro Express case at A, a diameter you and I'd like to know. Using the reference diameters at B, C, and D, and the distance (G) between B and D, AutoCAD made it easy to derive the diameter at A for the final case drawing (later in this chapter). I drew the rim (H), then the body line between B and D. Then AutoCAD's "extend" function dutifully extended the body line to the left, to the front of the rim. After I drew the rest of the profile down to the centerline from F, the "mirror" function flipped it over to form the full outline of the .470 Nitro Express. From this outline, AutoCAD's precise dimension readout delivered the diameter at A and entered it on the final drawing.

larger than the diameter that SAAMI's drawing shows at 0.200 inch from the datum line.

Occasionally, drawings from other sources show lengths and diameters at points you and I would consider strange, and omit the dimensions you and I find useful. Again, with AutoCAD, I draw these cases in the specified segments and use AutoCAD's "extend," "trim," and sometimes other commands to connect the lines correctly and to find the significant points where you and I want to know the dimensions.

The dimensions on the drawings, like the drawings themselves, should be as accurate as anyone can make them. In drawings that list "SAAMI maximums," the dimensions shown there are *not* dimensions taken off specimen cases. In drawings made from the dimensions of measured specimens, the figures aren't necessarily the dimensions of other cases for the same cartridge in someone else's rifle.

A single specimen case, for example, has three distinct mouth diameters at three different times: smallest after it's been resized but not yet plugged with a bullet, measurably larger with a bullet seated, and larger still when it's been fired but not resized. I haven't always been able to determine which mouth diameter I was drawing from, in making drawings of wildcat cases.

If I mike the neck of a fired, unsized case and you mike it after you've resized that case, you and I can get different readings off that case, using the same mike. But neither reading is an error. If I mike the shoulder diameter of a wildcat case one of us has die-formed and loaded, then you fire-form it and let me mike that diameter again, I'll get a larger figure for the second measurement. These variations in true measurements are one reason I've used official specs and maximums whenever I could get them.

There's no other reliable, fixed standard. When you use maximum dimensions as standards, then at least you know how much and in which direction the variations are "off."

There's no room for disputing the fact that SAAMI has specified a maximum shoulder diameter of 0.4410 inch (11.201 mm) for the .30-06 Springfield. There's no room for disputing the fact that a designer has specified a body length of 2.069 inches for his wildcat cartridge. Con-

fusion and legitimate disputes arise when, for example, one person measures the shoulder diameter of a fired .30-06 case, another fellow measures the shoulder diameter of an unfired .30-06 round, and neither specifies the origin of his measurement. Dimensions measured by anonymous sources, taken from unidentified specimens by undefined methods, are only roughly approximate at their best.

So you can safely assume the dimensions in some drawings are beyond dispute, while others are admittedly less reliable. The source named in parentheses in the upper right corner is your key to the reliability of the dimensions shown in that drawing. But don't assume too quickly that a listed dimension is "wrong" simply because it's a couple of thousandths of an inch different from your measurement of a case or the from the same dimension taken from some unidentified or only vaguely qualified source.

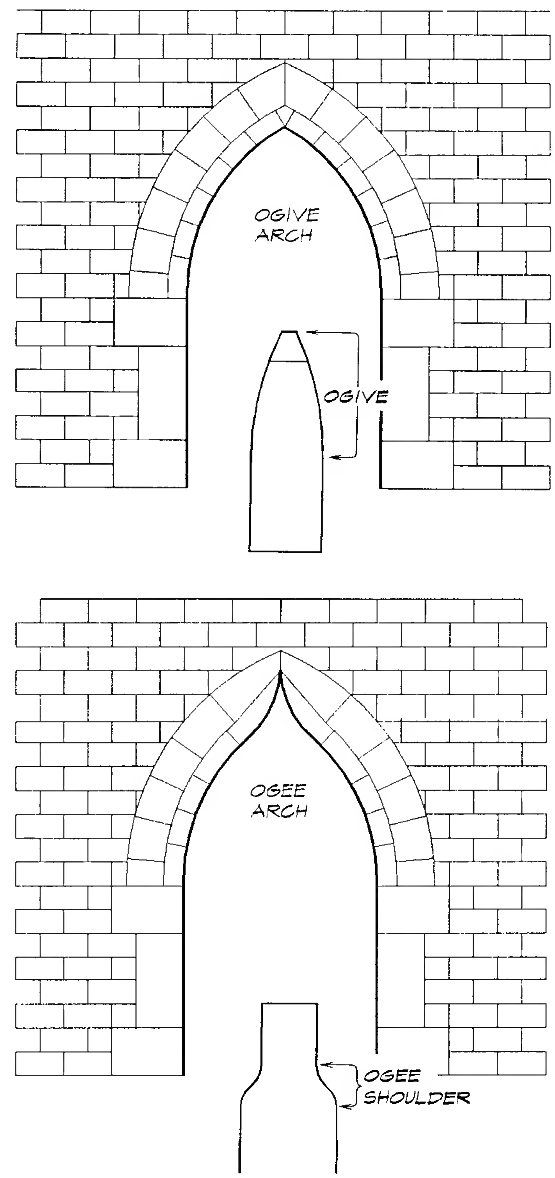
One consistency in my cartridge drawings may at first seem inconsistent. "Wildcat" designers usually base their case-head specifications on dimensions they've taken from cases, not from official specifications or maximums. Whenever I draw a wildcat cartridge based, for example, on the .30-06 Springfield, I use the SAAMI maximums specified for the .30-06 instead of the designer's case-head specs. All other dimensions, of course, are the designer's originally specified dimensions.

Most official case drawings show chamfered rims. Most of my drawings omit rim chamfers, scallops, and rounded edges — because I checked a number of specimen cases at random and found no chamfer on any of their rims.

I also omit the curves that soften the junctions where the shoulder lines intersect the body and neck lines. Official drawings typically note somewhere that "dimensions are to intersection of lines," so that's how I've drawn them for this collection of drawings. (Most authorities also use this convention.)

Shoulder Angles

The Weatherby cartridges, several old English and black-powder cartridges, and even a few wildcats eschew the angled shoulder and use instead an S-curved shoulder that no one can assign an angle. To describe this kind of shoulder — which shows in some of my drawings but not in the others — I use the old term *ogee*, derived from the plural form of the word that gave us the more familiar *ogive*. Both terms come to us from old architectural terminology for two kinds of curved arches.



Long ago, gun language borrowed the singular term ogive (pronounced OH-JIVE, to rhyme with GO STRIVE) from classical architecture to give a name to the curved forepart of a bullet. So I've borrowed the plural form of the same word, ogee (pronounced OH-JEE), from the same old terminology to have one terse, handy word for the reverse-curved shoulders of the Weatherbys, the Powell-Miller Venturi Freebores, and many old classic cordite and black-powder cartridges.

Some of the drawings in this chapter show angled shoulders but specify ogee shoulders — because I've had to draw these cartridges to their specified or nominal dimensions, not according to how they really appear.

Some authorities specify shoulder angles, but many don't. In dimensioning my drawings of some of these cartridges, I've shown no shoulder angle and instead have shown the specified diameters at the base of the neck and at the mouth. In other drawings, I've entered the actual shoulder angle that I derived with AutoCAD.

CIP specifies the angle from one side of the shoulder to the opposite side, which of course is exactly twice the angle between the shoulder and the longitudinal axis of the case. Using an electronic calculator that does angles in degrees, minutes, and seconds, I halved CIP's angles.

Some wildcatters specify shoulder angles that don't jibe with the lengths and diameters they specify for their cartridges. Did they specify their linear dimensions accurately, then roughly derive (guess or estimate) the shoulder angles these dimensions produce? Or did they establish shoulder lengths and diameters, specify shoulder angles, then calculate the axial distances from the heads to the junctions of the shoulders and necks of their cartridges?

I have no way to guess or know either the source or the locus of any of these errors. I haven't tried to correct these errors in many drawings, because I can't tell whether a length, a diameter, or a shoulder angle is out of line. If I guessed wrong and "corrected" the wrong dimension, I'd add — not subtract — an error.

Equivalents and Conversion Factors

AutoCAD automatically calculates and inserts the metric equivalents shown in brackets immediately after the inch dimensions. I've calculated the millimeter-inch equivalents to draw, in inch dimensions, the cases I've drawn from the Triebel and CIP maximums. (These authorities specify dimensions in millimeters, with no inch equivalents.) On a Texas Instruments TI-36 calculator beside my computer keyboard, I divide millimeter dimensions by the standard conversion factor 25.4 (the number of millimeters in an inch) and enter the result without rounding it off. AutoCAD rounds off inches to four decimal places and rounds off millimeters to two decimal places.

Dimensions that end in zeroes can be misleading. A case length shown as 2.5000 inches uses four decimal places merely as a format standard, not because the length is supposed to be precisely defined to the fourth decimal place. AutoCAD displays this case length as 2.5000 inches, even when it has been entered as 2.5 inches. You can usually and generally ignore all terminal zeroes.

How to Make 'em

Don't get the idea I know more about case conversions than I do. Obviously, I have not formed even a significant fraction of the cases I've drawn here. I haven't even seen most of them except in friends' cartridge collections.

I've often had to figure out, as well as I could, which parent or substitute case to use for a certain case and the best way to form it. I took proof copies of the case drawings to Huntington's and the RCBS custom-die shop, where Buzz Huntington and Bill Keyes pored over them and corrected the errors they found. I also sent drawings to Dave Cumberland — whose outfit ("The Old Western Scrounger") forms and loads custom cartridges for their customers — for their expert proofreading. These fellows spotted a pile of my bad guesses and straightened them out for me.

But I loaded a great pile of drawings onto them all at once, which they checked during busy business times, so I don't dare assume they saw every error there was to catch. There may well be a few left for you to find, and tell me about, so I can get them right in the next edition.

For a couple of good reasons, I haven't included all the comments that I got from Buzz Huntington and Bill Keyes.

First, the space under each case drawing is sometimes too small for repeating the complete instructions that come with the appropriate set of RCBS custom dies. When you get the recommended dies, you'll get all the details on how to use them correctly.

Second, Buzz and Bill advocate expanding case necks and shoulders mechanically, but I

don't. Fire-forming is the vastly superior way to expand cases. Mechanically expanded cases too often come out of the process lop-sided and usually come out shorter. Cases fire-formed with inert filler often come out even and a bit *longer*. Fire-forming with inert filler, described in Chapter 4, also offers several advantages over fire-forming with full loads. The inert-filler loads use much less powder and no bullet. You can fire-form cases almost anywhere, if you use inert fillers and light charges of fast powder.

This collection includes drawings of several cartridges I still don't know how to make from which parent cases. I've included these and others for their historical interest, for collectors and others interested in their dimensions but with no thought of deriving them from other cases.

Buzz Huntington's and Bill Keyes's advice on which parent cases to modify and how to modify them naturally and legitimately favors using RCBS form and trim dies (sets required for substantial or radical re-forming) or single, combination form-and-trim dies. What they advise may not be the only good case-forming procedure but is usually the best procedure. The accumulated knowledge of Fred Huntington's son and long-time custom-die specialist is far too awesome for me to question. You can depend on what they advise.

Other reasons for my pronounced bias in favor of RCBS are legitimate. Until very recently, RCBS was the only source of good custom dies for rare, obsolete, and wildcat cartridges. My pro-RCBS bias dates back to the mid-Fifties, when I had to abandon unsatisfactory "quality" handloading equipment and retool with RCBS equipment. Although RCBS has gone through significant changes of ownership and management while other manufacturers have improved their designs and quality, no other company has given me anything like the enthusiastic, voluntary cooperation I've always gotten from RCBS.

(The brands I discarded forty years ago are now owned by others who have brought their standards and quality up. Their products are worlds better than the junk that used to bear the same names.)

The absence of references to Redding custom dies is by no means significant. Redding's chief, Richard Beebe, is a cherished friend, but I can recommend his Redding custom dies only generally, through my faith in Richard himself and in his company's consistently high quality. I've neither seen nor used any of his custom dies, but I'm confident they're as good as any you can get from anywhere else. I simply don't know specifically what he offers. So where the advice under any of my cartridge drawings refers to RCBS dies, you may want to contact Richard Beebe to see whether the Redding custom shop makes (or will make) the dies you need to form and load that cartridge.

Factory brass is once again available for many foreign and "obsolete" cartridges — but usually not from original or traditional sources. In a delightful reversal of a long-time situation, brass is now available from outfits that don't make ammunition. Forming cases from some other shape of brass isn't necessary nearly so often as it was for so long. Used to be, we could get new brass only by buying loaded ammunition that often wasn't the caliber we wanted to load. The case manufacturers loaded ammunition and wouldn't sell empty brass. They thought handloaders were renegades, risks, or too small a market and didn't want our business.

Several new manufacturers, with new headstamps, have for several years been answering the demand for discontinued classic cases. Now, new factory-made brass is available with new brand names — A-Square, Bertram, HDS, and other proprietary brands. Huntington's (Chapter 7) always has a good variety of unusual, one-of-a-kind, hard-to-find brass on hand and often knows what the other major suppliers usually have in stock. So check with Huntington's first. You may not need any special or extra forming dies to make your case from some other case.

A few independent cartridge designers have specified using series of form and sizer dies in intermediate steps to form their wildcat cartridges. The intermediate dies they specify are often the regular sizers for other uncommon cartridges — dies that most handloaders don't have and can't easily find except by special mail order. Also, some are home-shortened versions of off-the-shelf dies. Most handloaders can't lop their dies off and can't conveniently have them

accurately ground to the right lengths without extra expense.

I can't possibly duplicate all these intermediate operations for so many cartridges, to verify their reliability. Some of them strike me as inconveniently complicated or even downright sloppy. So I can't recommend them. The one process I can confidently recommend is to use the appropriate sets of custom form, trim, and ream dies to modify the listed parent cases. Long, useful case life calls for the best treatment of your cases, especially when converting them to some other cartridge takes more than a simple full-length resizing or fire-forming.

The "how to make 'em" notes under a few of my drawings cite RCBS custom dies that RCBS doesn't make — yet. This note is not an error. If you have a firearm for one of these brand-new or otherwise unique cartridges, send Huntington's Die Specialties three to five fire-formed cases (not resized) or a Cerrosafe chamber cast (carefully packed). You will, in due course, get back a gorgeous set of exactly the right dies — the very first RCBS has ever made for your cartridge.

All RCBS custom dies come with instruction sheets that tell you, step by step, how to form the desired case from the appropriate parent case.

Gross and Net Case Capacities

I'm introducing, with these drawings, two features I hope you'll find useful, once you get the hang of what they mean and how to use them (they can be a little puzzling at first):

¤ the figures for a "solid model" (brass) of the case and how much water it displaces
¤ how much water a bullet of the designated diameter displaces when it's seated in the mouth of the case

These are simple and useful figures, easy to use — once you see what they mean. With these numbers, you can work out a pretty good estimate of case capacities — but only for comparing case volumes (not for entering case capacities in the computer programs for calculating beginning loads and other interior ballistics) and for designing cases to specific desired capacities.

Please remember: these figures are only estimates, not specifications and not measurements. Don't ever think of them as precise measurements of actual case capacities. *They are not* precise measurements of anything. Use only the average water-weight capacity of several actual cases as a basis for calculating starting loads — whether you use the Powley Computer for Handloaders, Load from a Disk, The Ballistics Program (more on these in Volume Two), or any other calculation scheme or device. Weigh several cases first empty and then full of water to the mouth, to get the actual, average gross capacity of those cases.

Do not use the characteristics of theoretical cases to load actual cases.

An interesting serendipitous feature of AutoCAD suggested using these "solid" figures as a way of *estimating* the gross capacity of the case. Different brands of cases with the same outside dimensions are often made to different inside dimensions, and any dimension of a specimen case is almost certain to be somewhat different from the maximum or specified dimension. The actual weight and capacity of any case — as a percentage of the weight and capacity of the solid model — depends on several normal but unpredictable variations in the actual dimensions of the case:

¤ the size and type of the primer pocket and primer vent or vents (large or small, rifle or pistol, Berdan or Boxer)
¤ the thickness and contour of the web
¤ the radius of the fillet at the junction of the web and the case wall
¤ the thickness and taper of the case wall

The weights of empty cases from the many sources of the .308 Winchester, for example, cover a wide range — as much as thirty to thirty-five grains difference between the lightest and the heaviest .308 Winchester cases, according to some reports. Yet all these cases have very nearly the same *outside* dimensions.

The "solid" and displacement figures in these drawings, in theory at least, let you compensate for these differences in the inside dimensions of the case and calculate its approximate net capacity for any bullet-seating depth.

Here's where these figures come from:

AutoCAD, given certain physical properties of the material specified for the object in the

drawing, gives back certain characteristics of the object. I gave AutoCAD the figures for seventy-thirty (70:30) cartridge brass, and it gives me the mass of the object (the "solid") in pounds and its volume in cubic inches. The solid is the case in the drawing, turned from solid 70:30 brass, *with no brass removed from the inside*. (Don't fret — this is necessary and easy to deal with.)

The weight of the solid, shown as so many grains of brass, is a basic reference. The other basic reference, its equivalent weight in grains of water, is how much water would occupy exactly the same space as the solid *brass* model of that case. Here's how to use these two figures to estimate the *gross* capacity of your brass, in grains of water, when it's filled to the mouth of the case:

¤ Weigh a typical case, primed but empty. Better still, weigh five or ten primed empties to get an average or typical net *empty* weight.
¤ Divide the typical weight of your empty case by the weight of the solid model in brass. (Let's say, for example, you get 0.25 as a result — just to make the figuring simple.)
¤ Subtract this figure from 1.000. (In our example, you'd get 0.75.)
¤ Multiply the result by the weight of the solid model in water. (In our example, 0.75 times, let's say, a water weight of 100 grains — to keep the figuring simple.)

This final figure approximates the gross capacity of your case, in grains of water — 75 grains in our example. But this is a case full of water, before you deduct however many grains of water the seated bullet would displace.

I'm not sure how accurately AutoCAD estimates these "solid" weights. This software is awesome when it deals precisely with actual routine measurements, but I'm not sure it can estimate the volumes of small, complex solids with anything like the same precision it calculates the properties of large machine parts.

Cartridge cases are pretty small models, and AutoCAD probably estimates more accurately the volumes of larger objects, using larger units of measure. So you should consider these figures and their results as estimates only, not as precise calculations. I wouldn't calculate any maximum load based on these weight estimates, nor even any near-maximum load. I offer them as only what I consider them to be — convenient reference numbers for evaluating and comparing *theoretical* case capacities — the only possible way to deal with the capacities of cases you don't have in hand.

I'm confident, though, that any errors in AutoCAD's weight estimates are slight compared to the wide range of weights typical of .308 Winchester cases from many sources. Thirty to thirty-five grains is a wide variation range for cases no larger than the .308 Winchester.

Bullet Diameters and Displacements

The bullet diameter listed at the right of the case drawing is usually the specified or maximum diameter and may not be the actual diameter of the bullet loaded by any manufacturer or available as a handloading component. Many cartridge drawings list no bullet diameter. For these, I've listed the nominal diameter of bullets available as handloading components.

Bullet diameters listed are reference figures that may not be appropriate for your particular barrel. Especially if your barrel is old or of foreign manufacture, you should slug it to find its bore and groove diameters. Several new guns also demand careful checking, for both accuracy and safety. The inside dimensions of both old and new barrels for several old Sharps and Winchester black-powder cartridges demand special attention, because they vary widely from one barrelmaker to another.

In the modern replicas of some old black-powder guns, the bore and groove diameters are so strange, I would never think of forming or loading cartridges for them until I'd slugged the barrels, determined the exactly proper bullet diameters for those barrels, and had the forming and loading dies custom-made to fit. The groove diameters would determine not only the proper bullet diameters but also the proper associated diameters in the forming and loading dies for those particular guns.

The *grains per inch* figure is the amount of water a bullet of that diameter would displace if it were seated one inch. Multiply this figure by the seating depth of your bullet to calculate how much, in grains of water, your seating depth

reduces the capacity of the case.

For example, a bullet 0.224 inch in diameter, if it were seated an inch into the case, would displace 9.97 grains of water. But no .22 bullet I've ever seen was an inch long, so this figure is just a useful reference number.

Multiply 9.97 by 0.225 for a bullet seated 0.225 inch into the case neck, and the product — 2.24325, rounded off to 2.2 — reveals that this bullet, when you seat it this deep, reduces the gross capacity of the case by 2.2 grains of water.

The displacement figure for a typical .45 rifle bullet (".458 bullet displaces *41.66* grains per inch," for example), enables you to calculate how much to deduct from the gross capacity of a case to determine the net capacity of that case with a bullet seated in its mouth.

For example, let's seat a .458 bullet 0.458 inch into the neck. Simple arithmetic tells us the bullet displaces 19.08028 grains (0.458 times 41.66) — or 19.1 grains, rounded off to a tenth of a grain. If the gross capacity of the case is, say, 75 grains, subtract the displaced 19.1 grains from the gross capacity of 75 grains, and the theoretical net capacity is 55.9 grains of water.

Homer Powley's handy little computer for handloaders, and computer software based on Homer's math, use this net-water-capacity figure as a starting point for their calculations. It's also a handy way to compare the capacities of different cases. Just remember, **net water capacity is not necessarily net powder capacity**. The net capacity of any case, in grains of water, is not its net capacity *in the same weight* of powder. Net capacity in grains of water is a reference number, not related in any way to any specific powder, and certainly not the weight of a powder charge.

Regrettable Omissions

A cardinal decision in designing *Custom Cartridges* was whether to include a lot more drawings based on thin data, or fewer drawings limited by the number of best data I could get. I trust you'll endorse my decision to limit this work to the most dependable, authentic dimensions possible, even though I've had to omit a regrettable number of grand old pedigreed and wildcat cartridges because I couldn't ferret out reliable sources for their dimensions. I could get the Playmate of the Month's measurements — but wouldn't know how to draw her with AutoCAD — easier than I could get case dimensions for classic wildcats by Fred Barnes; Elgin Gates; the Juenke brothers; Powell and Miller; Charlie O'Neil, Elmer Keith, and Don Hopkins; P O Ackley; and others. I'm afraid some of these grand old wildcatters left little or no paper trail, but I hope to find data to enable me to include their cartridges in Volume Two or in the second edition of this volume, years down the road. All these cartridges deserve inclusion, and I hope Volume One of *Custom Cartridges* will flush out some reliable source drawings for Volume Two.

Errors — Real and Imagined

Some tribes and clans of the world make mistakes on purpose. They claim they do this to honor God, by whatever name they call Him, when they make sure anything they make has a flaw in it. The notion is that only He can make anything perfect, so it's presumptuous for us humans to make anything that has no flaw. This quaint view strikes me as not the humility they claim for it but the ultimate in arrogance. Its base premise is "If I don't make sure to insert a flaw, my work will be perfect [and I'll be like The Great Spirit]". Well, I know how far above the neck my feet of clay reach, so I don't fret that I may turn out something as good as God would make it. No human can even come close.

You can be sure that any mistake in these drawings got past me on its own steam. I know they're there, though I've tried to keep them out, but I don't know what or where they are. I take the blame for the deed, all right, but not for intent. So if you spot one, let me know. I'll correct it for the second edition.

I want to root out any error, but please keep in mind that seeming "discrepancies" between figures published here and dimensions that you and others measure on specimen cartridges are inevitable. Don't let them fool you. Expect the base diameter in a drawing to be larger than the base diameter of any of your cases for that cartridge, if the drawing shows maximums from SAAMI, Triebel, or CIP, for example.

Expect a larger or smaller figure if I've made my drawing from its designer's specifi-

cations, and don't be surprised by any discrepancy you see between your measurements and those, say, in a drawing made from measurements taken off a specimen cartridge.

Here's an example of a real error that I inadvertently put into one of my drawings. Fortunately, a friend spotted it, and I corrected it. I had asked the computer to give me the diameter of the rim, had been interrupted by a phone call, then had come back to the computer and entered that figure as the diameter of the base just ahead of the rim. The error was obvious enough, but nothing on the drawing indicated which figure was supposed to be there.

You would have seen the wrong figure and would've known it was wrong, but you wouldn't have been able to figure out the real diameter from anything on the drawing.

Not so obviously, my original drawing of the 7mm IHMSA International was wrong — and that version got into the first printing (forty thousand copies) of the new *Speer Reloading Manual Number 12* before I learned of the erroneous dimensions and corrected the drawing for this volume of *Custom Cartridges* and later printings of the Speer manual. All the fault and blame for the wrong dimensions in that first drawing of the 7mm IHMSA International are mine — not the fellows' at CCI-Speer Operations. In fact, it was one of the fellows at Speer who noticed one of these errors in the new manual (too late to correct it in their book) and told me about it.

This is not the end of this chapter — the first pair of dimensioned case drawings (of the more than nine hundred in this first volume) wait for you to turn the page.

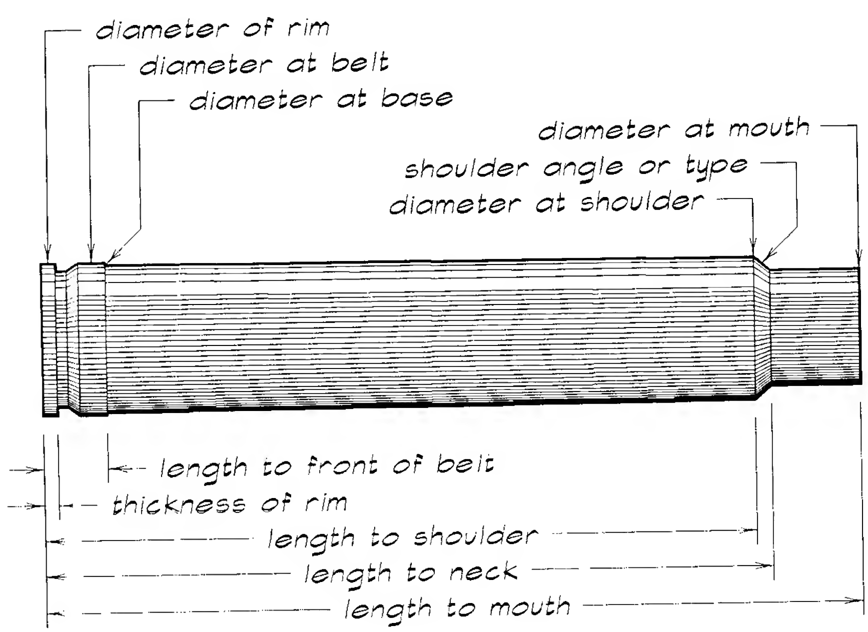
These case drawings appear in the same numerical order as they're listed in the index that begins on page 587 — 'way back at the end of the book.

KEY TO THE CARTRIDGE DRAWINGS

SCALE 1.5-to-1 (1.5x)

cartridge designation used by source

(source of data)

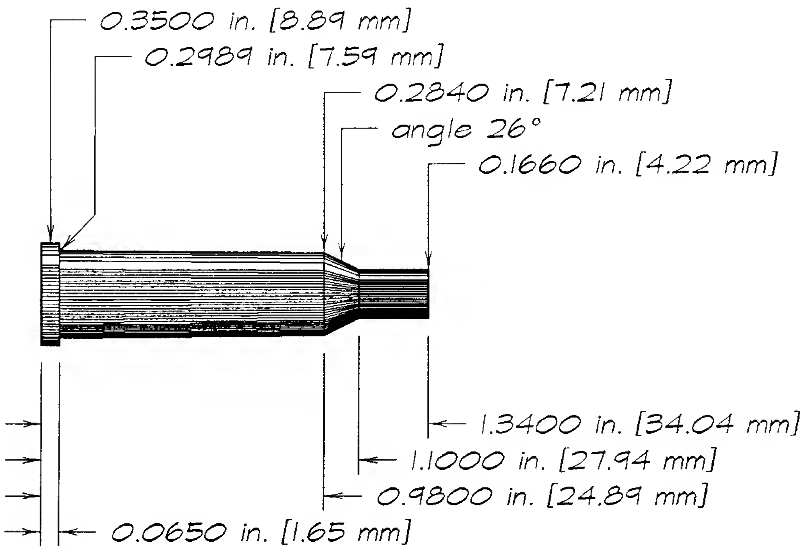


weight of a solid model (gr) turned to these dimensions in solid brass -- water (gr) displaced by a solid model

diameter of bullet (from source) and water (gr) displaced by bullet seated 1.0 inch into case

Brass to use (if it's available) and how to form it (if forming is necessary) -- not necessarily the only brass, nor the only way to modify it, but the recommended brass and the recommended forming method

.14 Walker Hornet (specimen cartridge)

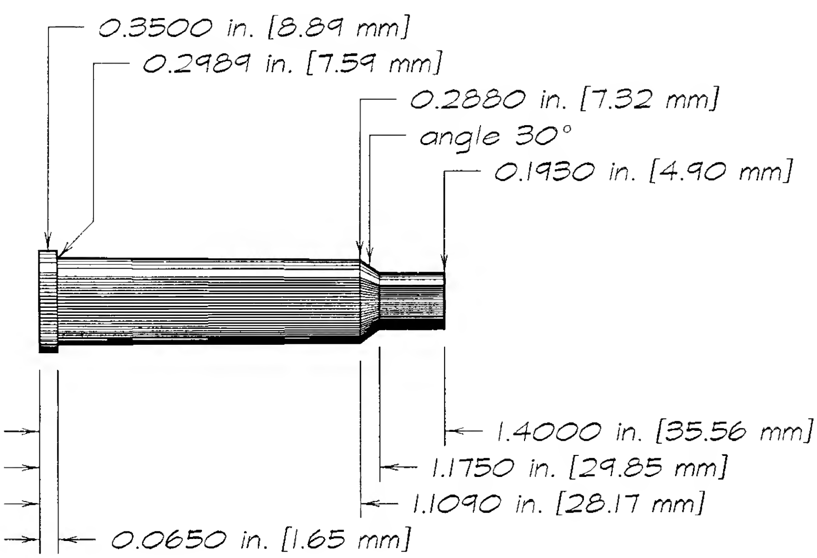


solid:
152 gr brass
18 gr water

.144 bullet displaces
4.12 grains per inch.

Anneal neck and shoulder of .22 Hornet brass. Resize full-length in .14 Walker Hornet sizer die. Fire-form.

.17 Ackley Hornet (David J LeGate)



solid:
181 gr brass
21 gr water

.172 bullet displaces
5.88 grains per inch.

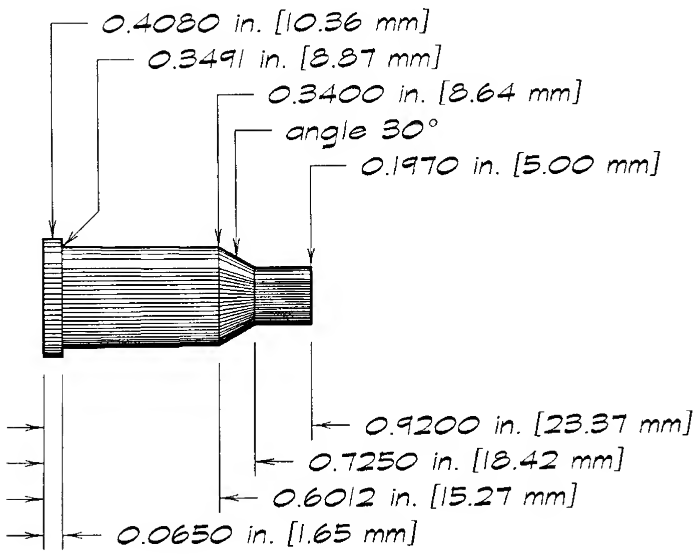
Form from .22 Hornet brass, in RCBS form dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.17 Bumblebee

(David J LeGate)

solid:
138 gr brass
16 gr water



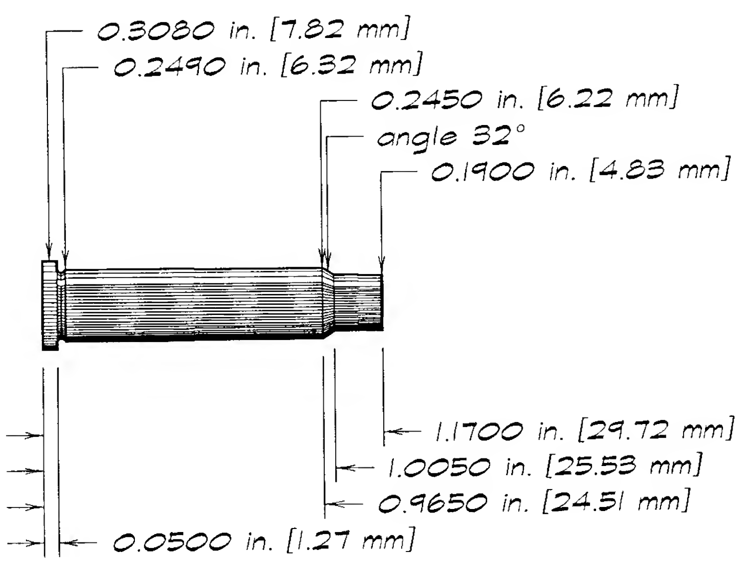
.172 bullet displaces
5.88 grains per inch.

Anneal neck and shoulder of .218 Bee brass. Form and trim in RCBS form and trim dies. Ream inside neck, in RCBS neck-ream die. Fire-form with inert filler.

.17 CCM (Cooper Centerfire Magnum)

(Cooper Arms specimen)

solid:
117 gr brass
14 gr water



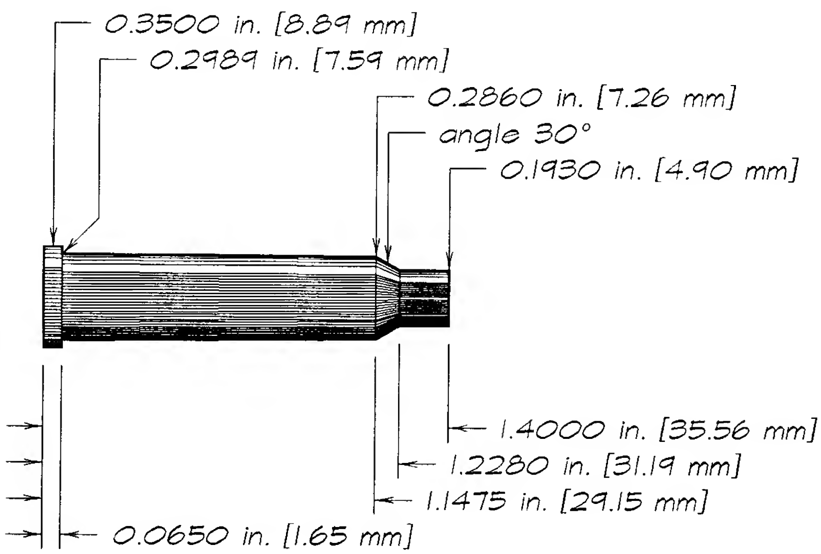
.172 bullet displaces
5.88 grains per inch.

Use factory .17 CCM brass. Or size .22 CCM brass full-length in .17 CCM sizer die. Fire-form with inert filler or moderate load.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.17 KEHornet

(designer's specs)



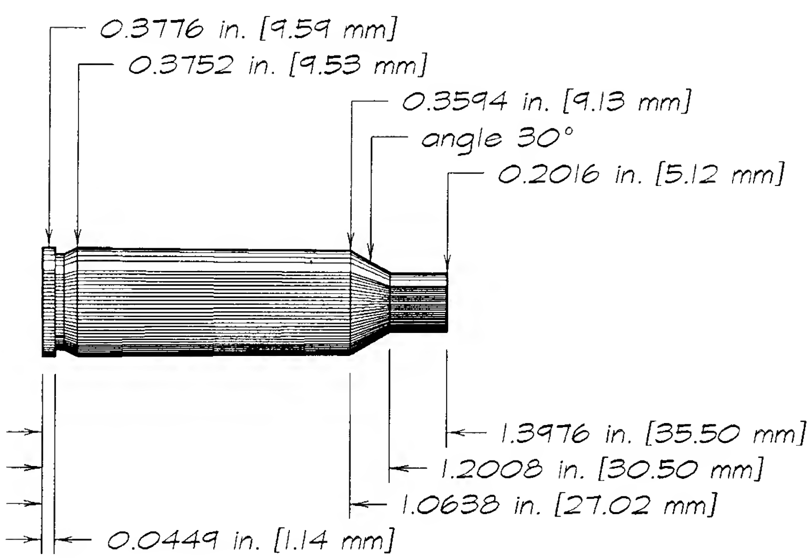
solid:
185 gr brass
22 gr water

.172 bullet displaces
5.88 grains per inch.

Resize .22 Hornet brass full-length in .17 KEH die. Fire-form with moderate load or inert filler.

.17 Mach IV

(Triebel maximums)



solid:
275 gr brass
32 gr water

.172 bullet displaces
5.88 grains per inch.

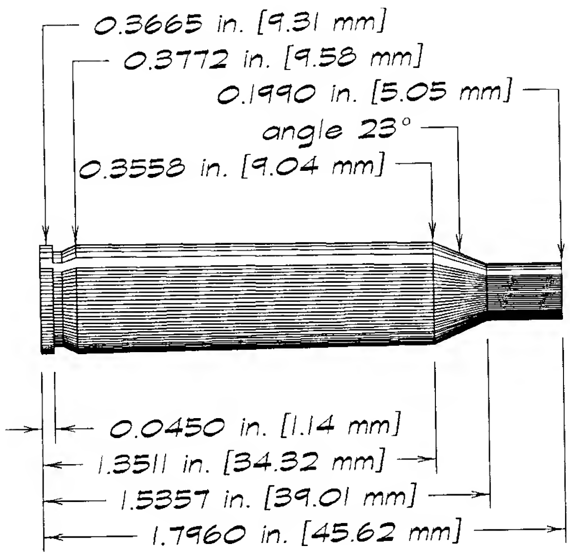
Form from .221 Remington Fireball brass, in RCBS form and trim dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.17 Remington

(SAAMI maximums)

solid:
348 gr brass
41 gr water



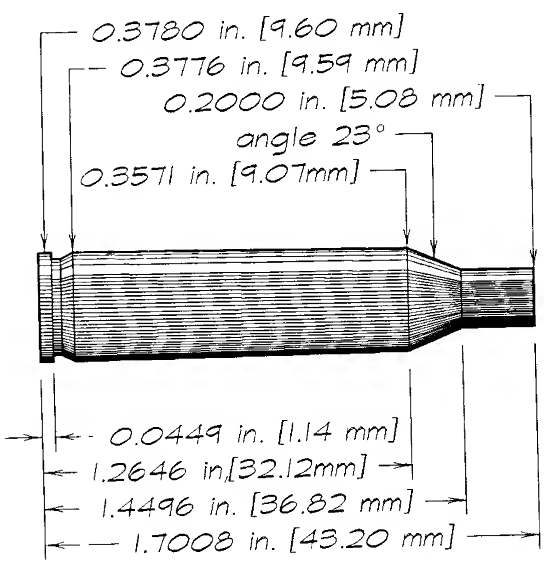
.172 bullet displaces
5.88 grains per inch.

Use factory .17 Remington brass. Or form from .223 Remington brass, in RCBS form dies (case forms short).

.17-.222 Remington

(Triebel maximums)

solid:
329 gr brass
39 gr water

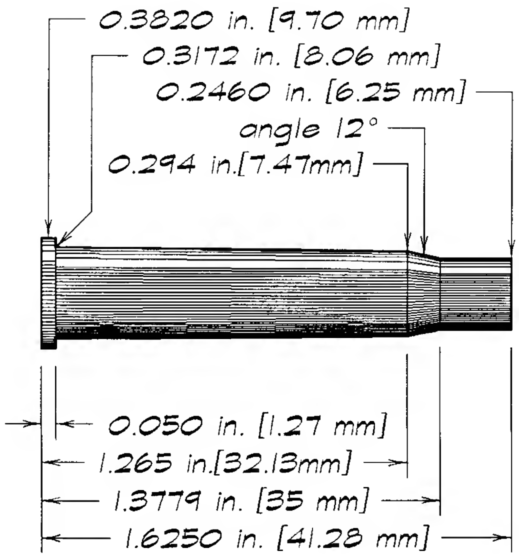


.172 bullet displaces
5.88 grains per inch.

Form from .222 Remington brass, in RCBS form dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

2-R Lovell (Speer manual number 4)

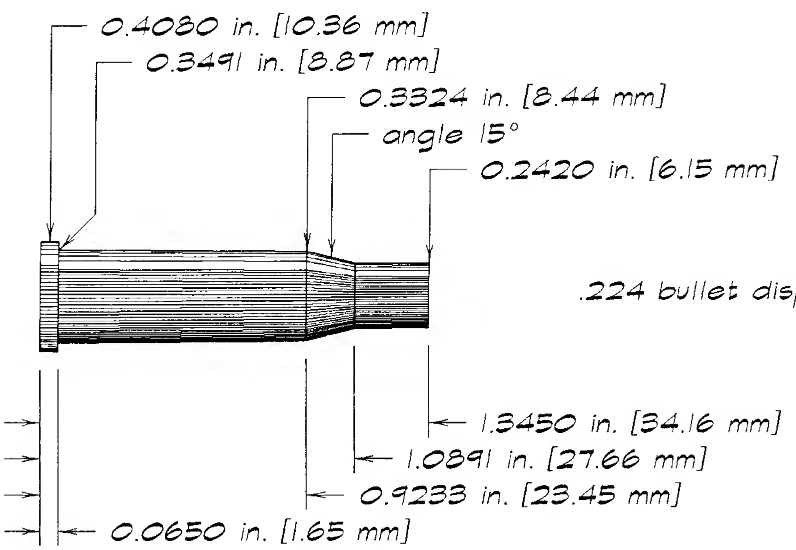


solid:
244 gr brass
29 gr water

.224 bullet displaces
9.97 grains per inch.

Anneal neck and shoulder of recently manufactured .25-20 Single-Shot brass. (NOT .25-20 Winchester) Form and trim in RCBS form and trim dies. Deburr.

.218 Bee (SAAMI maximums)



solid:
229 gr brass
27 gr water

.224 bullet displaces 9.97 grains per inch.

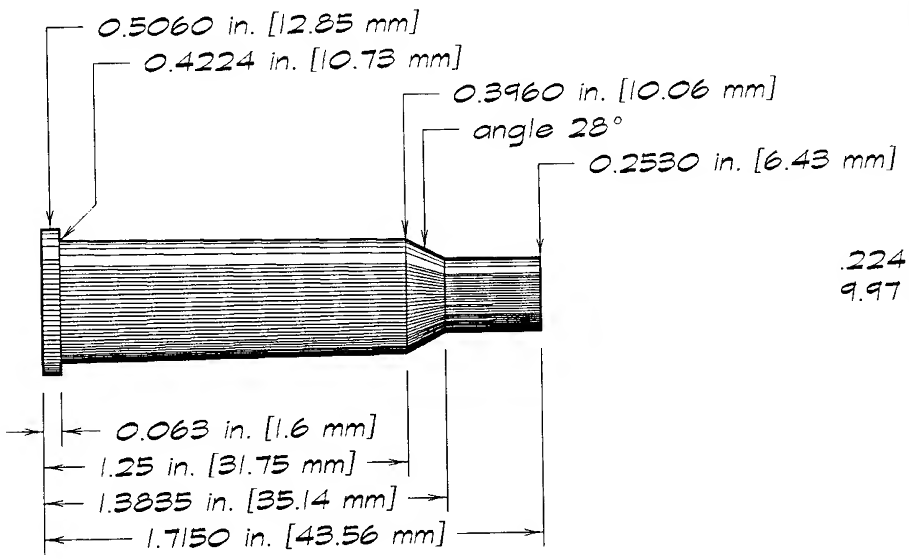
Use factory .218 Bee brass. Or form from recently manufactured .32-20 Winchester brass, in RCBS form dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.219 Donaldson Wasp

(Speer manual number 4)

solid:
425 gr brass
50 gr water



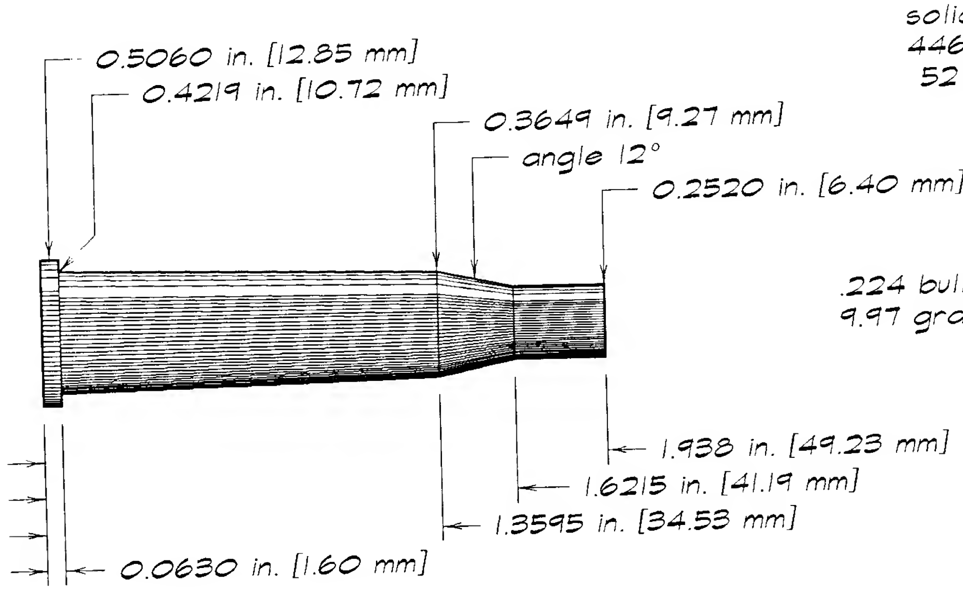
.224 bullet displaces
9.97 grains per inch.

Form from .25-35 Winchester, .30-30 Winchester, or .219 Zipper brass, in the respective RCBS form and trim dies.

.219 Zipper

(SAAMI maximums, 1965)

solid:
446 gr brass
52 gr water

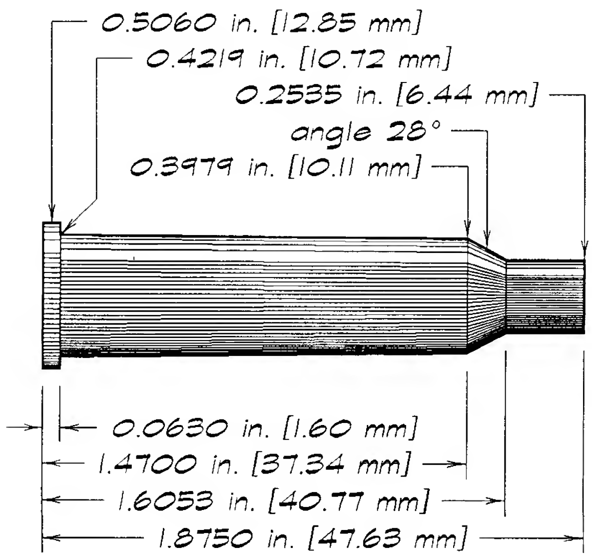


.224 bullet displaces
9.97 grains per inch.

Form from .25-35, .30-30, or .32 Winchester Special brass, in respective RCBS form dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.219 Improved Zipper (Speer manual number 4)



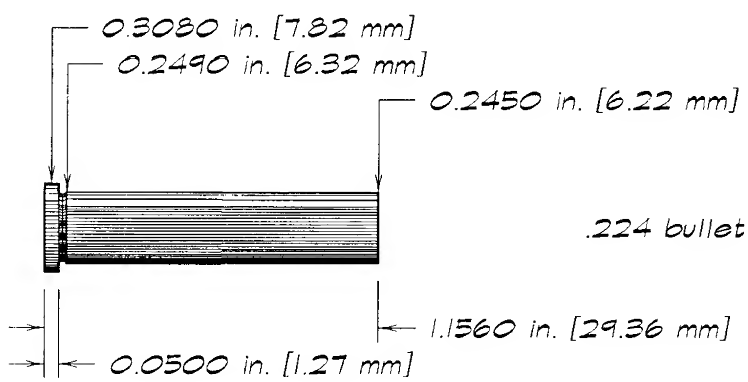
solid:
446 gr brass
52 gr water

.224 bullet displaces
9.97 grains per inch.

Form from .25-35 Winchester, .30-30 Winchester, or .32 Winchester Special brass, in respective RCBS form and trim dies. Fire-form with inert filler.

.22 CCM (Cooper Centerfire Magnum) (Cooper Arms drawing)

solid:
124 gr brass
15 gr water



.224 bullet displaces 9.97 grains per inch.

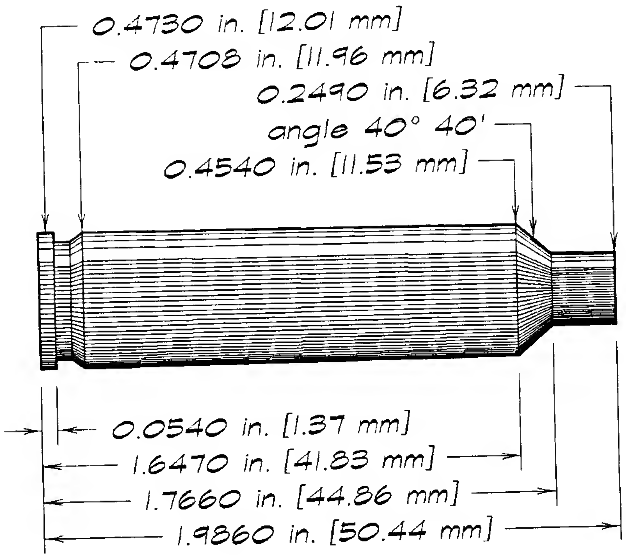
Use factory .22 CCM brass only.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.22 CHeetah Mark I

(David J LeGate)

solid:
638 gr brass
75 gr water



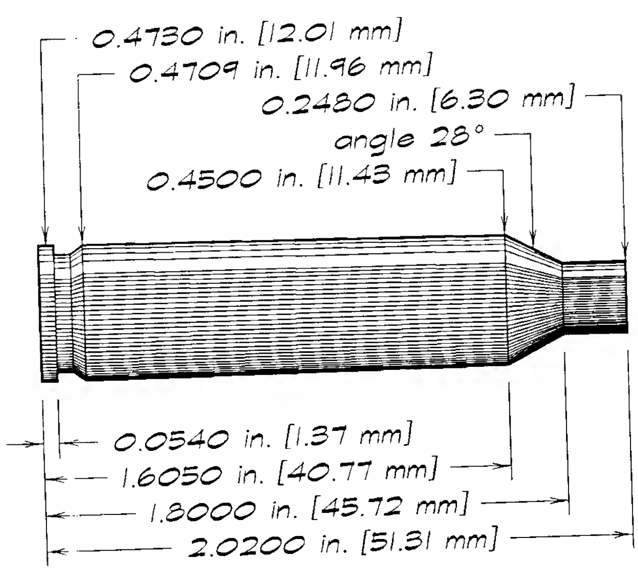
.224 bullet displaces
9.97 grains per inch.

Form from .243 Winchester (preferred), .308 Winchester, or Rem BR brass, in RCBS form die. Ream inside neck, in RCBS neck-ream die.

.22 Cheetah Mark II

(David J LeGate)

solid:
636 gr brass
75 gr water



.224 bullet displaces
9.97 grains per inch.

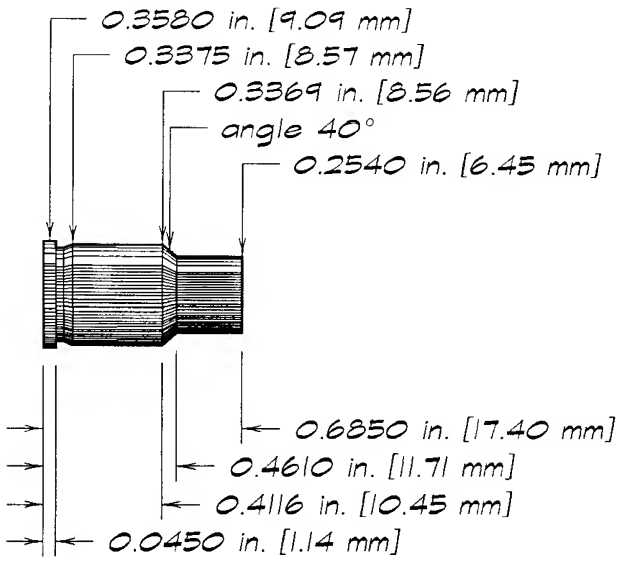
Form from .243 Winchester (preferred), .308 Winchester, or Rem BR brass, in RCBS form dies. Ream inside neck, in RCBS neck-ream die. Trim and deburr.

Anneal only by method shown in text. *Text explains use of "solid" and displacement figures.*

.22 Flea

(designer's specs)

solid:
113 gr brass
13 gr water



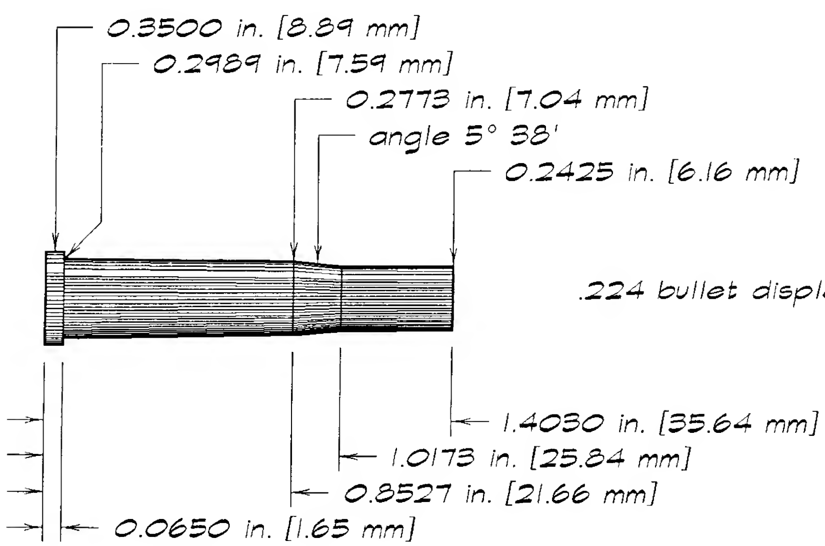
.224 bullet displaces 9.97 grains per inch.

Form from .32 Auto (.32 ACP) brass, in RCBS form dies.

.22 Hornet

(SAAMI maximums)

solid:
179 gr brass
21 gr water



.224 bullet displaces 9.97 grains per inch.

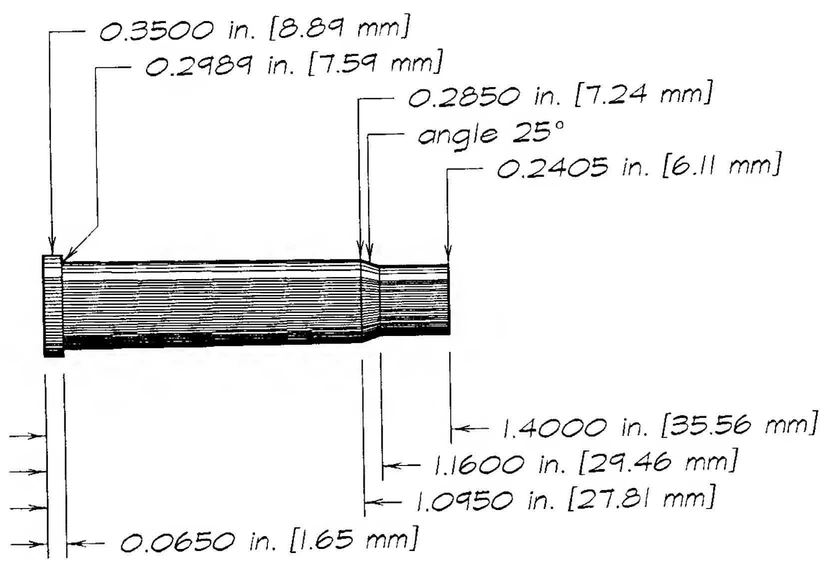
Recently made factory brass is plentiful and easy to find. (Good thing, too! No other case can become a Hornet case, not even by witchcraft.

Anneal only by method shown in text. *Text explains use of "solid" and displacement figures.*

.22 Hornet Improved (Niedner)

(David J LeGate)

solid:
187 gr brass
22 gr water



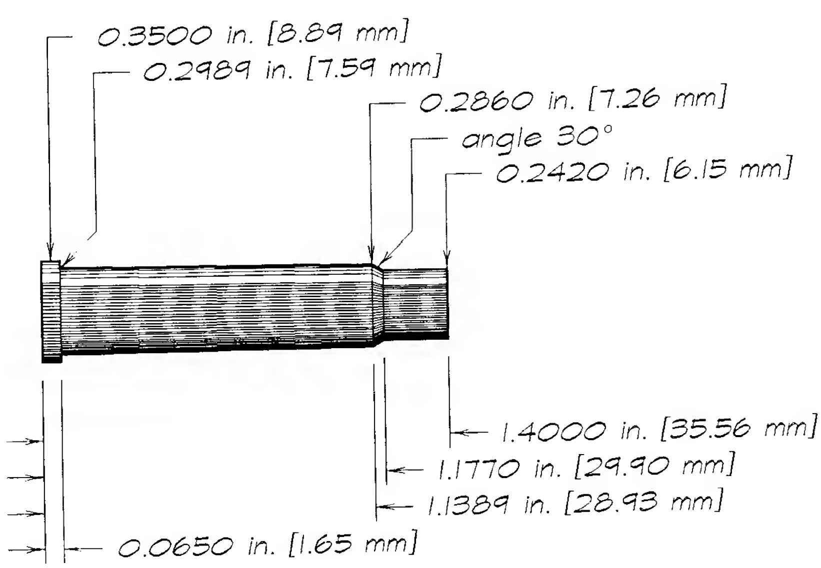
.224 bullet displaces
9.97 grains per inch.

Fire-form .22 Hornet ammunition. Or fire .22 Hornet brass with inert filler.

.22 KEHornet

(designer's specs)

solid:
191 gr brass
22 gr water



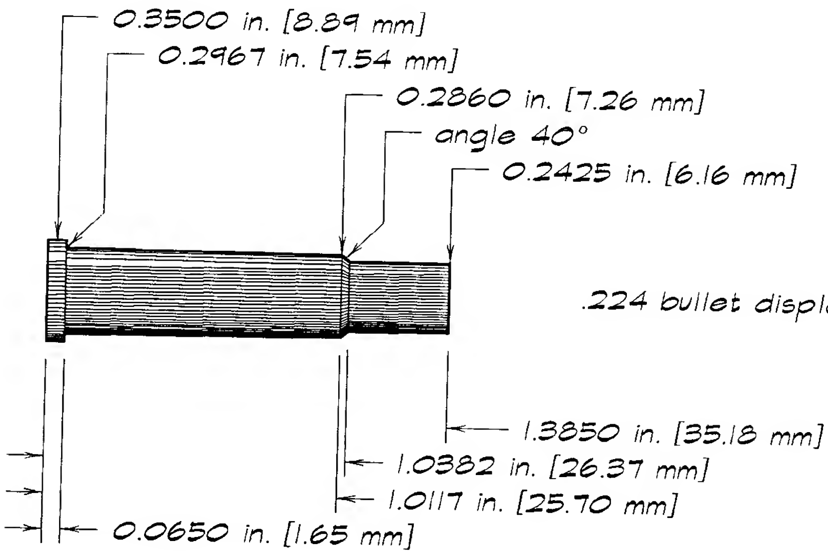
.224 bullet displaces
9.97 grains per inch.

Fire .22 Hornet ammunition in KEHornet chamber. Or fire-form .22 Hornet brass with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.22 K-Hornet

(RCBS drawing)



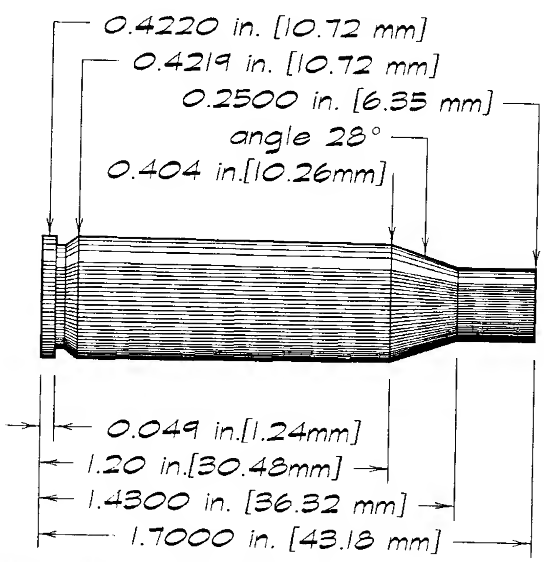
solid:
182 gr brass
21 gr water

.224 bullet displaces 9.97 grains per inch.

This little jewel is the original fire-formed wildcat case. Simply fire a .22 Hornet round in a K-Hornet chamber. Or fire-form .22 Hornet brass with inert filler.

.22 Lindahl Chucker, Rimless

(David J LeGate)



solid:
411 gr brass
48 gr water

.224 bullet displaces 9.97 grains per inch.

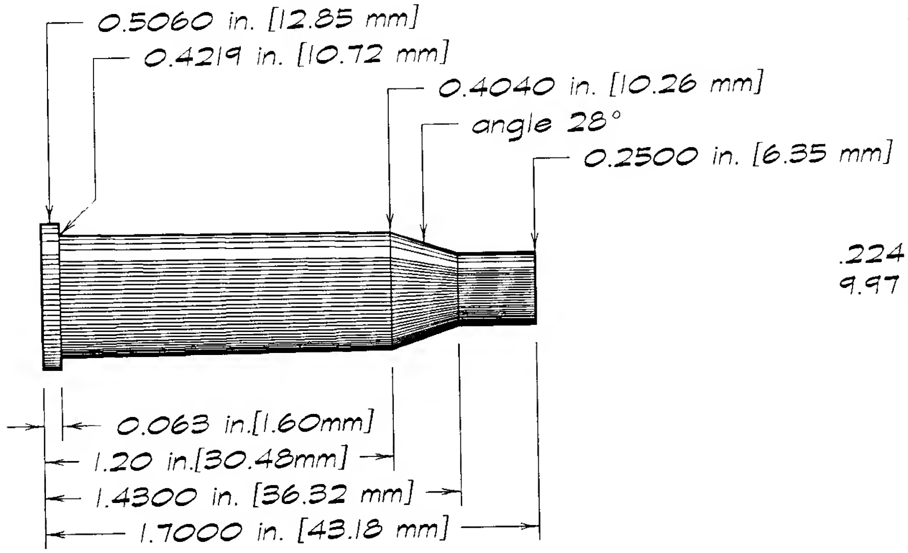
Anneal neck and shoulder of .25, .30, or .32 Remington brass. Shorten to 1.70 inches. Resize full-length in .22 Chucker (Rimless) sizer die. Trim to length and deburr mouth.
DO NOT CONFUSE this cartridge with the RIMMED .22 Lindahl Chucker.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.22 Lindahl Chucker, Rimmed

(David J LeGate)

solid:
425 gr brass
50 gr water



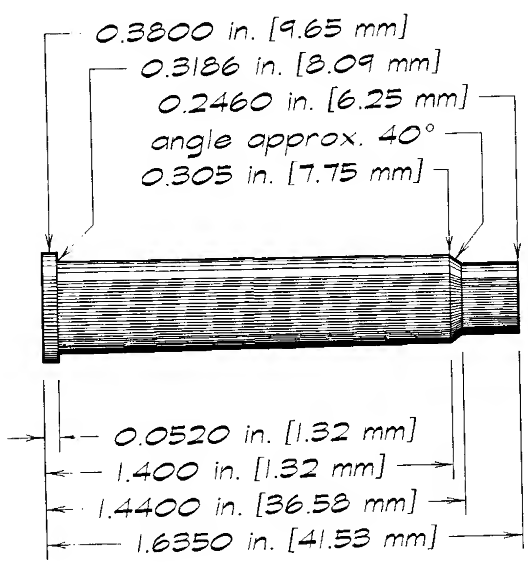
.224 bullet displaces
9.97 grains per inch.

Anneal neck and shoulder of .25-35 Winchester, .30-30 Winchester, .32 Winchester Special, or .219 Zipper brass. Shorten to 1.7 inches. Resize full-length in .22 Chucker (Rimmed) sizer die. Ream inside neck if necessary. Trim to length and deburr mouth.
DO NOT CONFUSE this cartridge with the RIMLESS .22 Lindahl Chucker.

.22 Maximum Lovell

(David J LeGate)

solid:
257 gr brass
30 gr water



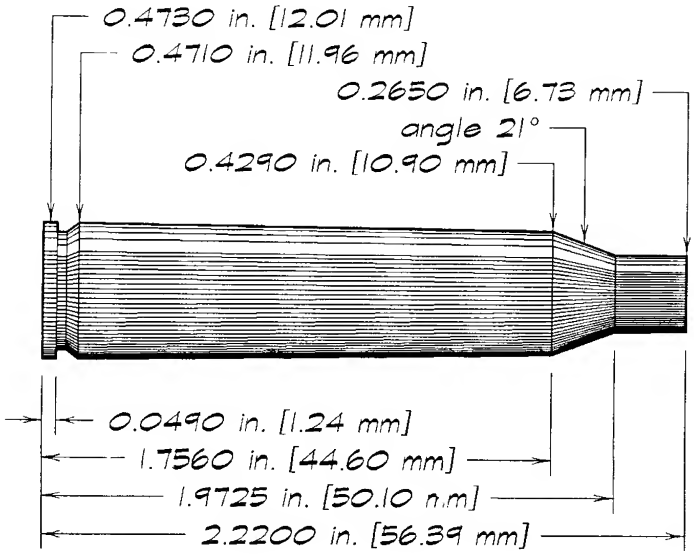
.224 bullet displaces
9.97 grains per inch.

Resize .25-20 Single-Shot brass (NOT .25-20 Winchester!) full-length in Maximum Lovell sizer die. Fire-form with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.22 Newton

(Newton drawing*)



solid:
691 gr brass
81 gr water

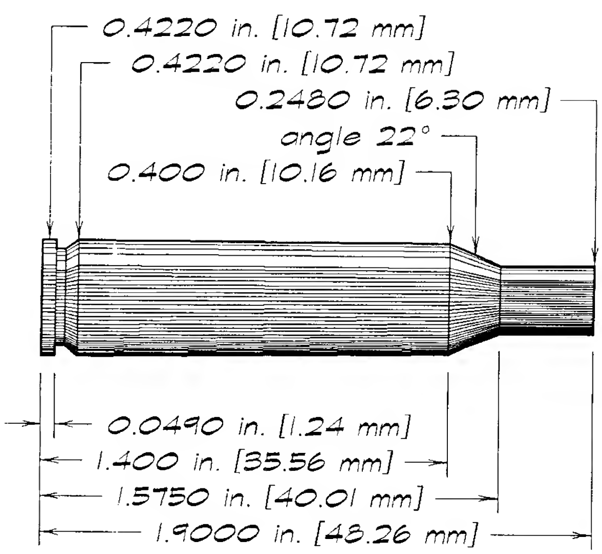
.228 bullet displaces
10.32 grains per inch.

Form from .30-06 Springfield brass, in RCBS form-and-trim dies.

*derived from Newton factory dimensions for .22 Newton chamber

.22 Niedner Magnum, Rimless

(David J LeGate)



solid:
462 gr brass
54 gr water

.224 bullet displaces
9.97 grains per inch.

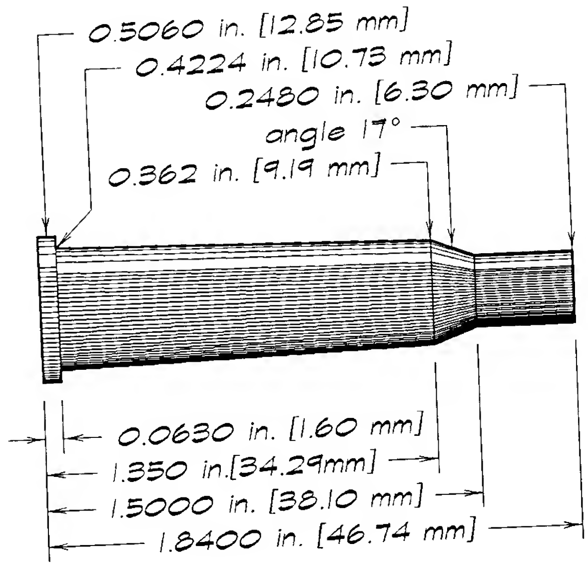
Anneal neck and shoulder of .25 (or .30 or .32) Remington brass. Form in RCBS form-and-trim die. Ream neck, in RCBS ream die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.22 Niedner Magnum, Rimmed

(David J LeGate)

solid:
427 gr brass
50 gr water



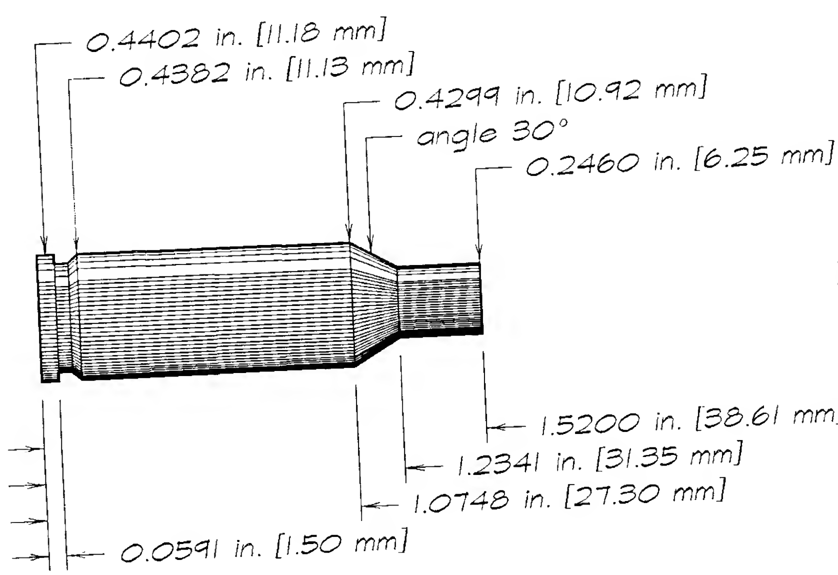
.224 bullet displaces
9.97 grains per inch.

Anneal neck and shoulder of .25-35 Winchester brass. Form in RCBS form-and-trim die. Ream inside neck, in RCBS neck-ream die. Trim and deburr.

.22 PPC

(CIP, fired specimens)

solid,
397 gr brass
47 gr water

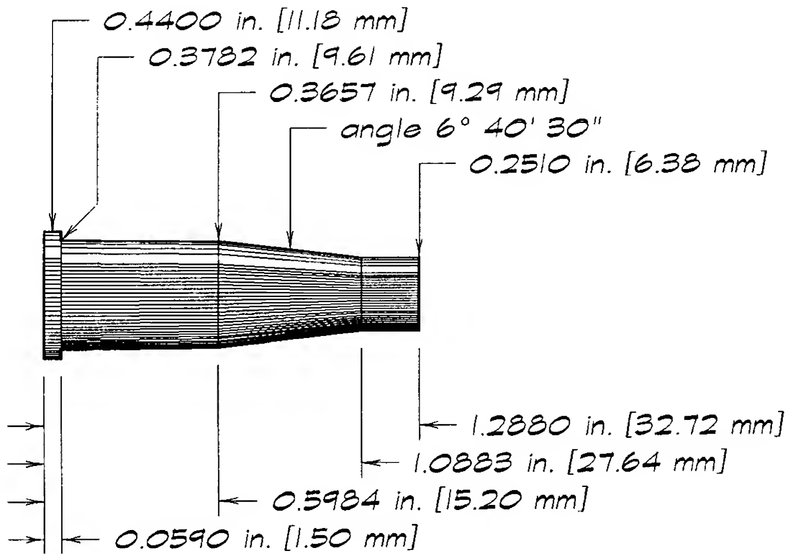


.224 bullet displaces
9.97 grains per inch.

Form from .220 Russian or 7.62x39mm brass, in RCBS form-and-trim dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.22 Remington Jet Magnum (SAAMI maximums)

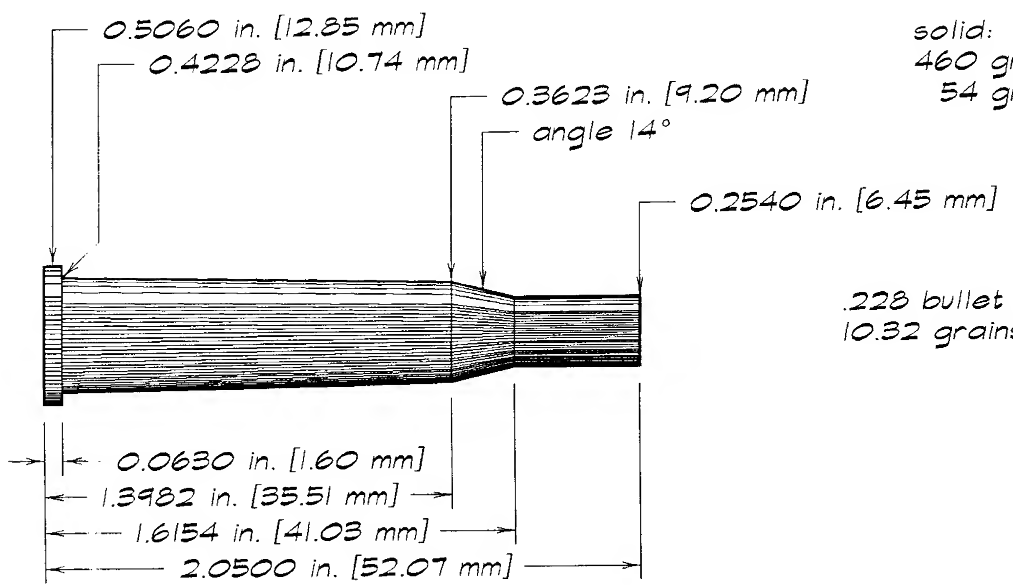


solid:
239 gr brass
28 gr water

.222 bullet displaces
9.79 grains per inch.

Use factory .22 Remington Jet brass. Or form from .256 Winchester Magnum or .357 Magnum brass, in respective RCBS form dies.

.22 Savage (.22 Imp, .22 Hi-Power) (SAAMI maximums, 1956)



solid:
460 gr brass
54 gr water

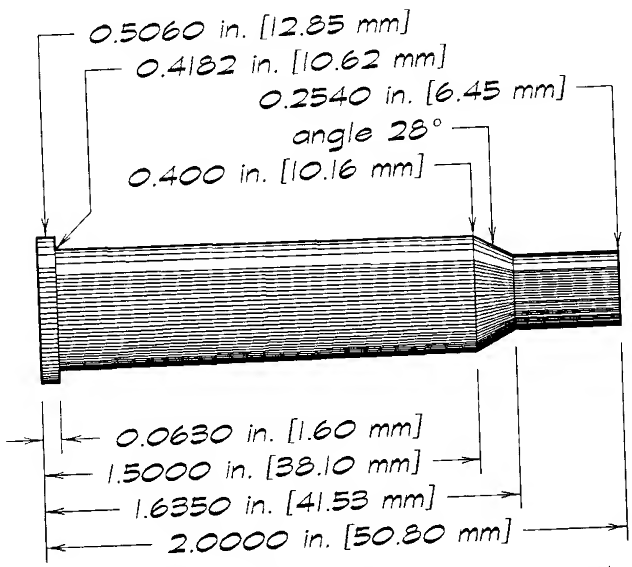
.228 bullet displaces
10.32 grains per inch.

Form from .25-35 or .30-30 Winchester, in respective RCBS form and trim dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.22 Savage Improved (Ackley* version) (David J LeGate)

solid:
502 gr brass
59 gr water

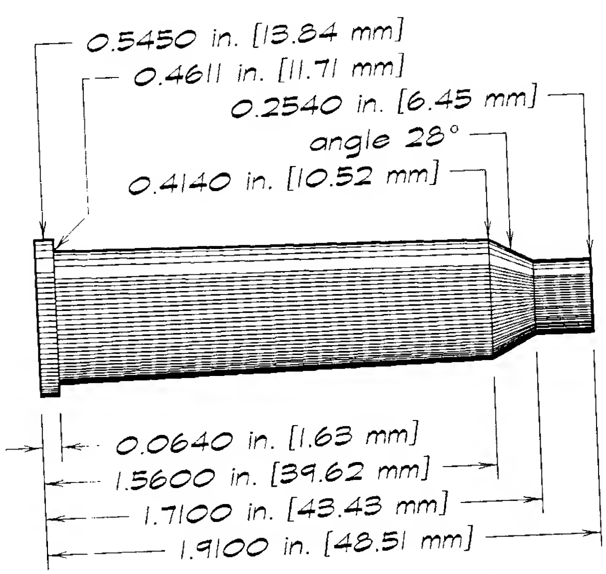


.224 bullet displaces 9.97 grains per inch.

Fire-form .22 Savage Hi-Power brass with inert filler. Or form .22 Savage cases from .25-35 or .30-30 Winchester brass, in respective RCBS form and trim dies, then fire-form with inert filler.
* Hervey Lovell designed two slightly different versions. Lysle D Kilbourn and Al Marcianti also designed similar contemporary versions.

.22 Short Krag (David J LeGate)

solid:
571 gr brass
67 gr water



.224 bullet displaces 9.97 grains per inch.

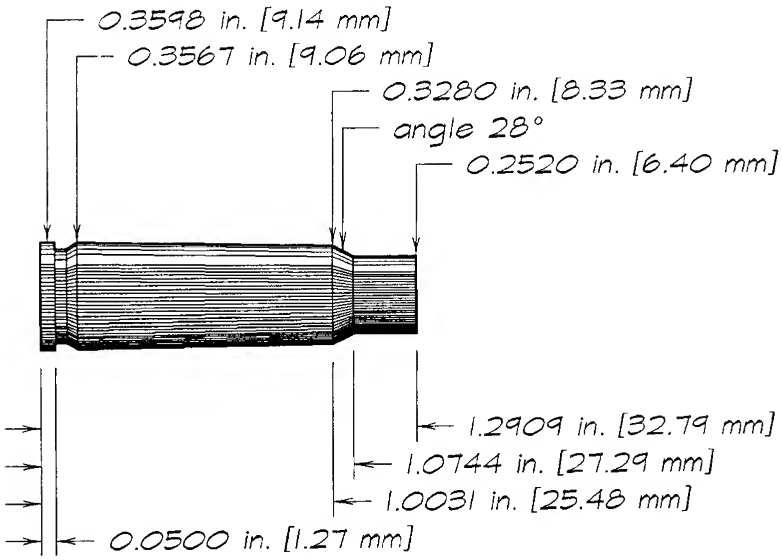
Anneal neck and shoulder of .30-40 Krag brass. Form and trim in RCBS form and trim dies. Deburr mouths. Load in .22-.250 loading dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.22 Spitfire

(Triebel maximums)

solid:
235 gr brass
28 gr water



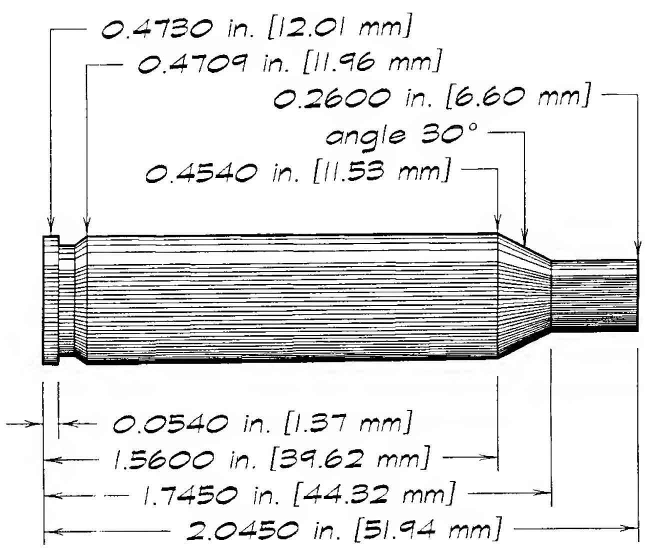
.224 bullet displaces
9.97 grains

Anneal mouth of .30 Carbine brass and form in RCBS form dies.

.22-.243 (Middlested's)

(David J LeGate)

solid:
636 gr brass
75 gr water



.224 bullet displaces
9.97 grains per inch.

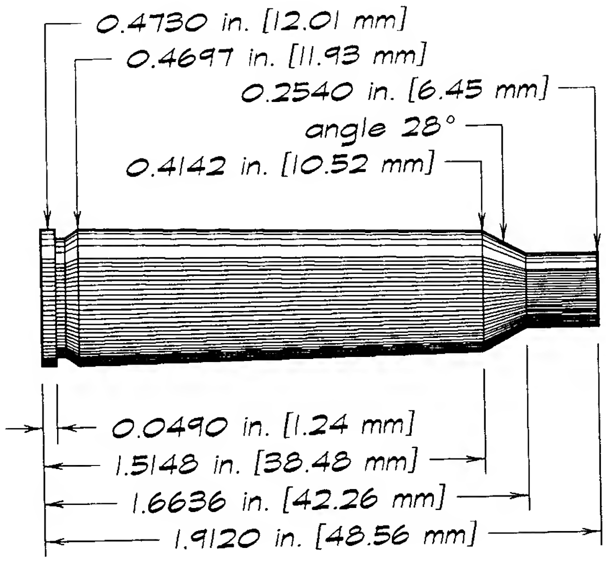
Form from .243 Winchester brass, in RCBS form die. Fire-form with inert filler.
Ream inside neck, in RCBS neck-ream die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.22-.250 Remington (.22 Varminter)

(SAAMI maximums)

solid:
578 gr brass
68 gr water



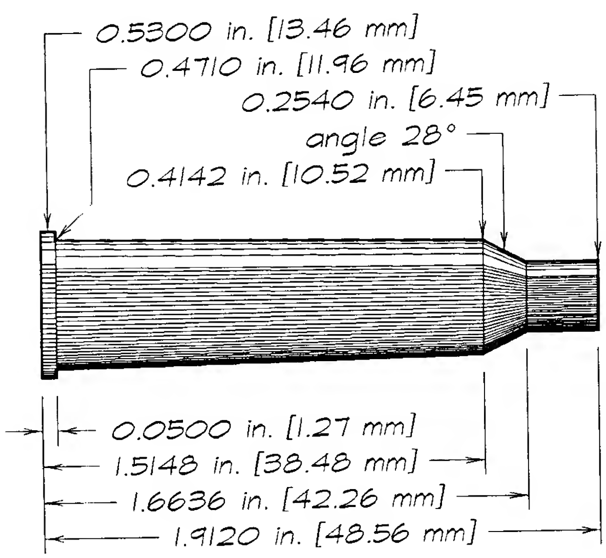
.224 bullet displaces 9.97 grains per inch.

Good, fresh factory brass is readily available. Or resize .250 Savage brass full-length in .22-.250 sizer die. Or form from .308 Winchester or .30-06 brass, in RCBS form and trim dies.

.22-.250 Rimmed

(designer's specs)

solid:
572 gr brass
67 gr water

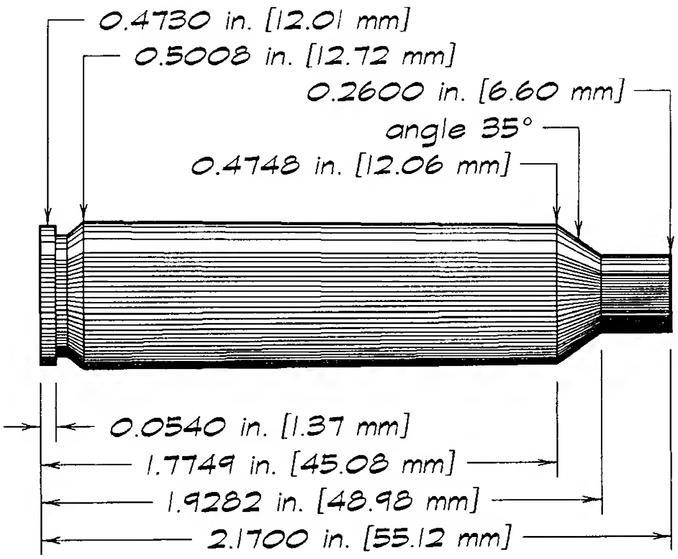


.224 bullet displaces 9.97 grains per inch.

Anneal shoulder and upper body of .400-.350 NE brass. Form and trim in RCBS form and trim dies. Ream inside neck. Deburr.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.22-.284 Winchester (designer's specs)

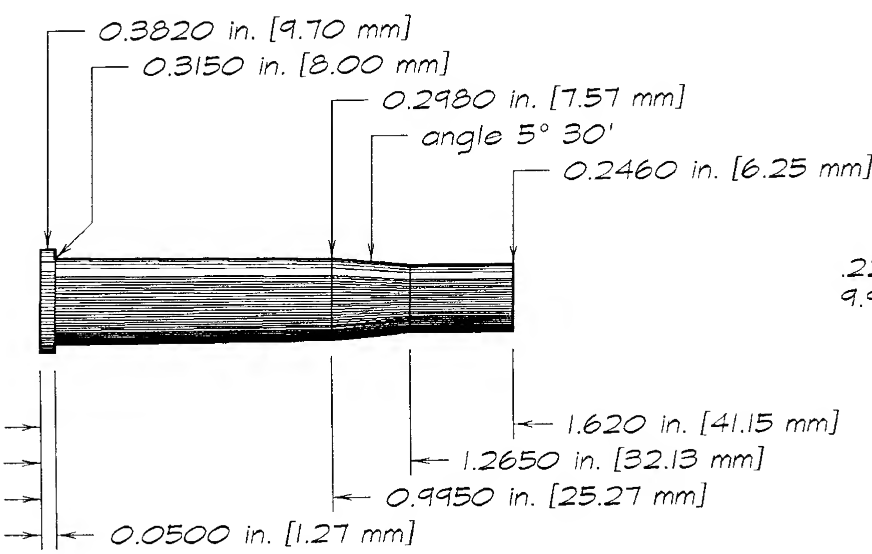


solid:
710 gr brass
83 gr water

.224 bullet displaces
9.97 grains per inch.

Form from .284 Winchester brass, in RCBS form, trim, and neck-ream dies.

.22-3000 Lovell (Speer manual number 4)



solid:
231 gr brass
27 gr water

.224 bullet displaces
9.97 grains per inch.

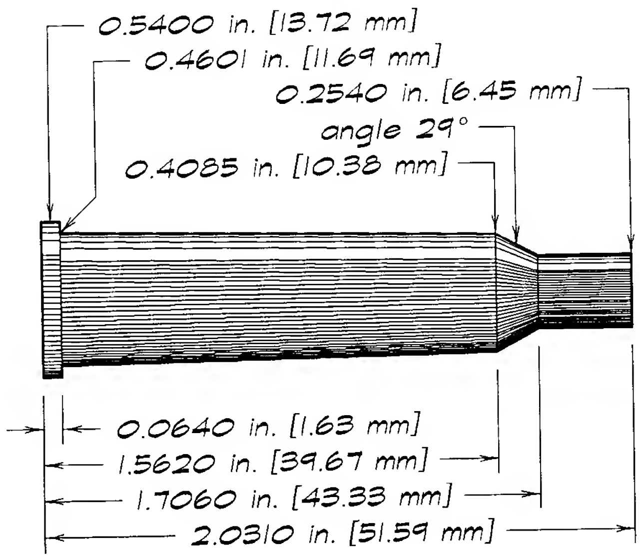
Anneal recently manufactured .25-20 Single-Shot brass (NOT .25-20 Winchester).
Form and trim in RCBS .22-3000 Lovell form and trim dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.22-.303 Varmint-R

(David J LeGate)

solid:
576 gr brass
68 gr water



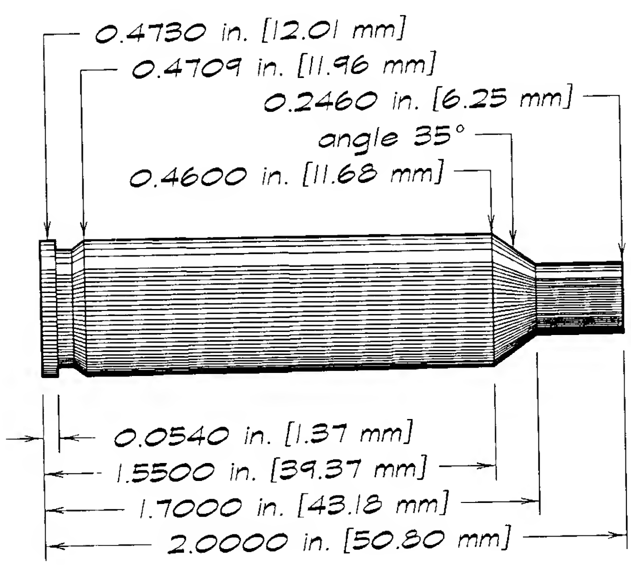
.224 bullet displaces
9.97 grains per inch.

Anneal neck and shoulder of .303 British brass. Form and trim in RCBS form and trim dies. Ream inside neck, in RCBS neck-ream die. Deburr.

.220 Jaybird

(David J LeGate)

solid:
623 gr brass
73 gr water

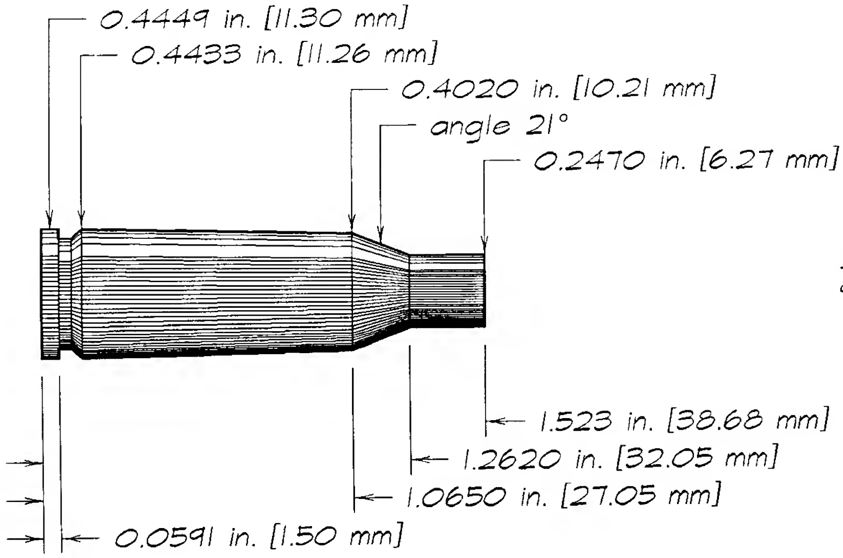


.224 bullet displaces
9.97 grains per inch.

Form from .243 Winchester brass, in RCBS form-and-trim die. Ream inside neck, in RCBS neck-ream die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.220 Russian (unfired specimen)

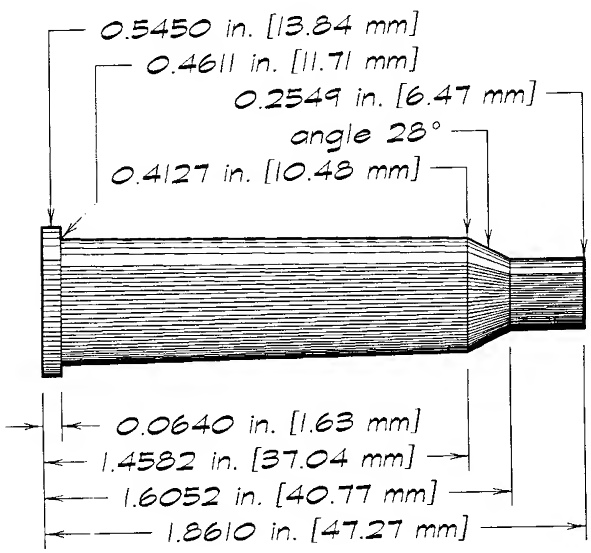


solid:
360 gr brass
42 gr water

.224 bullet displaces
9.97 grains per inch.

Use factory .220 Russian brass. Or resize .22 PPC or 6mm PPC brass full-length in .220 Russian sizer die.

.220 Saunders Krag (F K Elliott drawing)



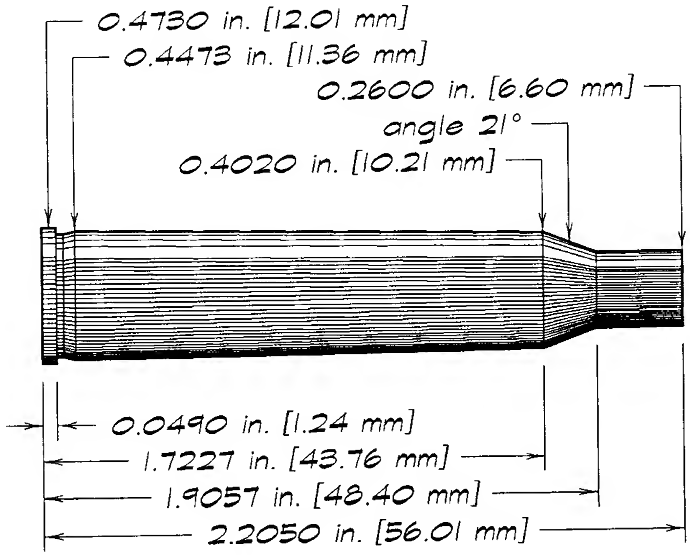
solid:
543 gr brass
64 gr water

.224 bullet displaces
9.97 grains per inch.

Anneal neck, shoulder, and upper body of .30-40 Krag brass. Form and trim in RCBS form and trim dies. Ream inside neck, in RCBS neck-ream die. Deburr.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.220 Swift (SAAMI maximums)

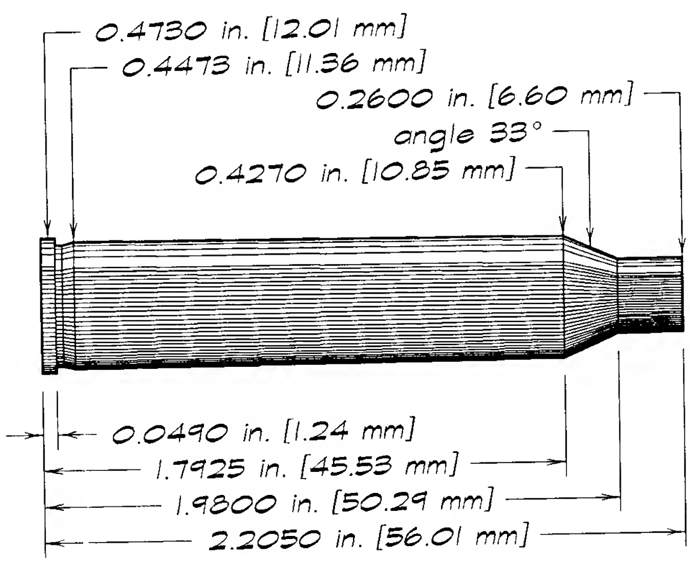


solid:
577 gr brass
68 gr water

.224 bullet displaces
9.97 grains per inch.

Use factory .220 Swift brass. Unthreaded special RCBS base-forming dies, to form .220 Swift cases from .30-06 brass, require an arbor press. These cases then require form, trim, and neck-ream dies before you can load them with reduced loads only. So use factory .220 Swift brass.

.220 Weatherby Rocket (David J LeGate)



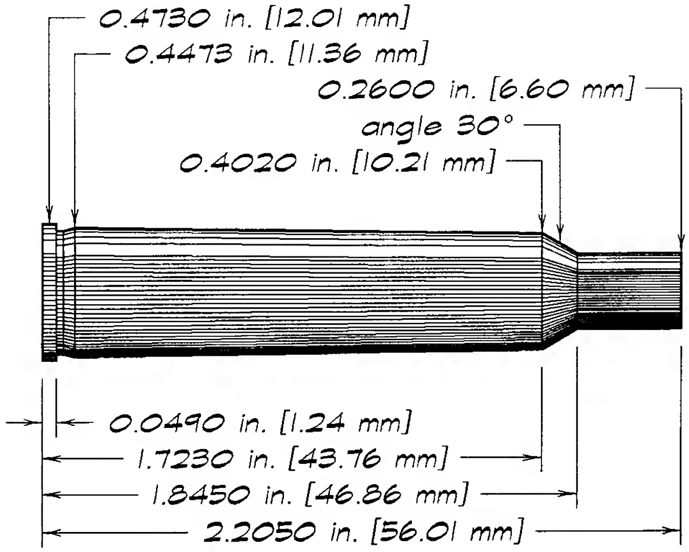
solid:
679 gr brass
80 gr water

.224 bullet displaces
9.97 grains per inch.

Fire .220 Swift ammunition, or fire-form .220 Swift brass with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.220 Watkins-Wilson Arrow (David J LeGate)

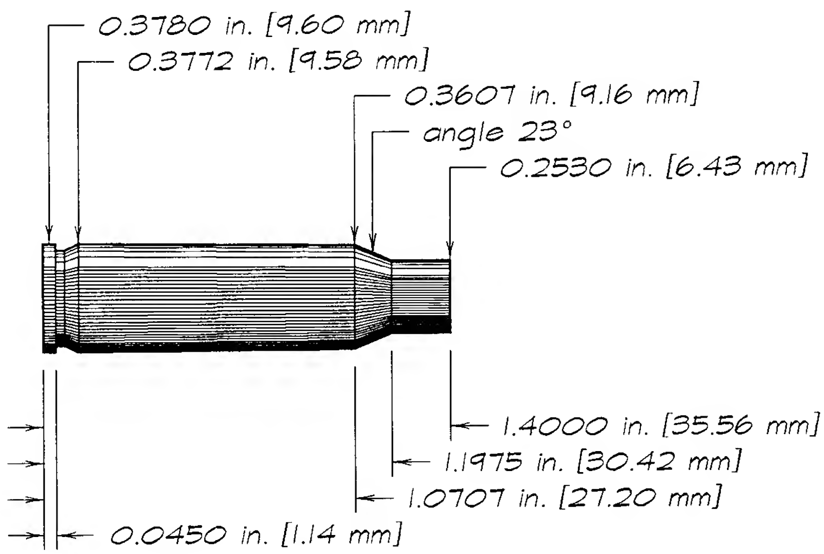


solid:
573 gr brass
67 gr water

.224 bullet displaces
9.97 grains per inch.

Resize .220 Swift brass in .220 Arrow sizer die and fire-form with inert filler.

.221 Remington Fireball (SAAMI maximums)



solid:
285 gr brass
33 gr water

.224 bullet displaces
9.97 grains per inch.

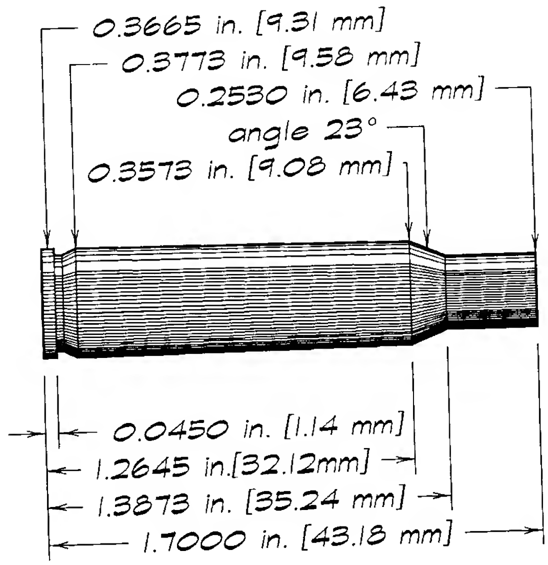
Use factory .221 Fireball brass. Or form from .222 Remington or .223 Remington brass, in respective RCBS form and trim dies. Ream neck, in RCBS ream die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.222 Remington

(SAAMI maximums)

solid:
312 gr brass
37 gr water



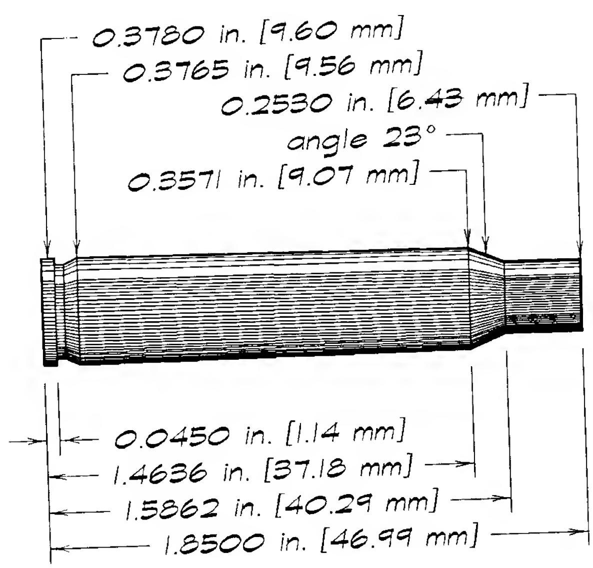
.224 bullet displaces 9.97 grains per inch.

Use factory brass (usually plentiful). Or resize .223 Remington brass full-length in .222 Remington sizer die, trim to length, and deburr.

.222 Remington Magnum

(SAAMI maximums)

solid:
379 gr brass
44 gr water



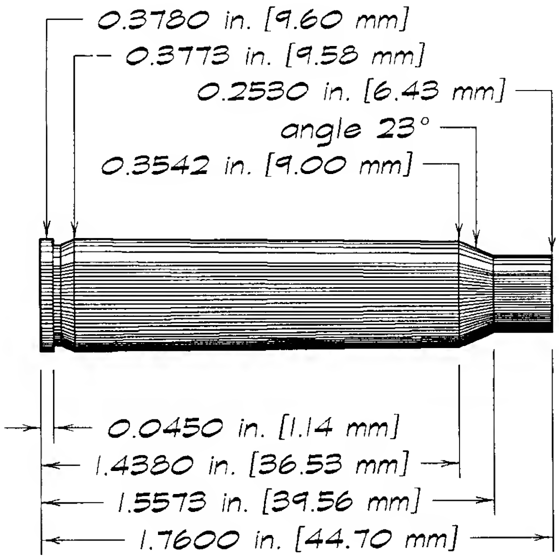
.224 bullet displaces 9.97 grains per inch.

Don't consider anything else; use only factory .222 Remington Magnum brass. This one is the longest member of its family, so no other member is long enough.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.223 Remington (SAAMI maximums)

solid:
366 gr brass
43 gr water

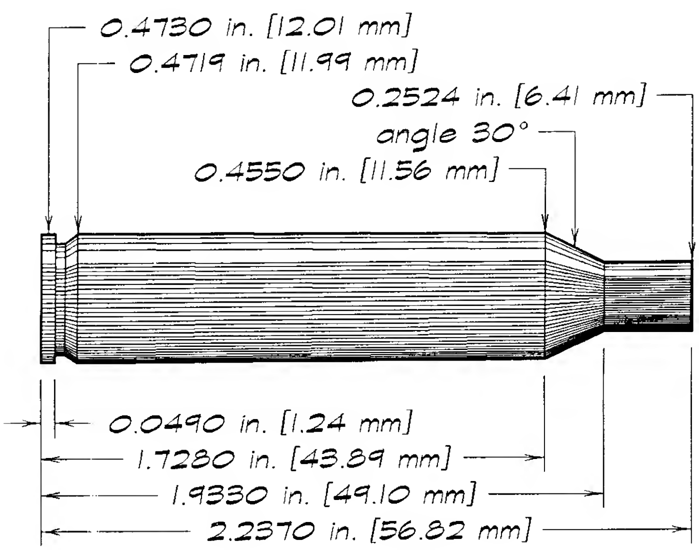


.224 bullet displaces 9.97 grains per inch.

This is one of the most plentiful of factory-made cases. Commercial and military cases are abundant. But if you have to, form from .222 Remington Magnum brass, in RCBS form and trim dies. Trim. Deburr.

.224 Clark (David J LeGate)

solid:
699 gr brass
82 gr water



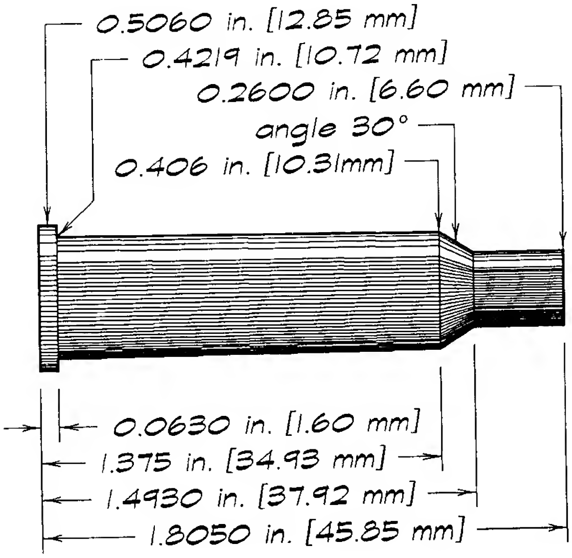
.224 bullet displaces 9.97 grains per inch.

Form from .257 Roberts brass, in RCBS form and trim dies. Ream inside neck, in RCBS neck-ream die. Trim. Deburr.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.224 Donaldson Ace

(David J LeGate)



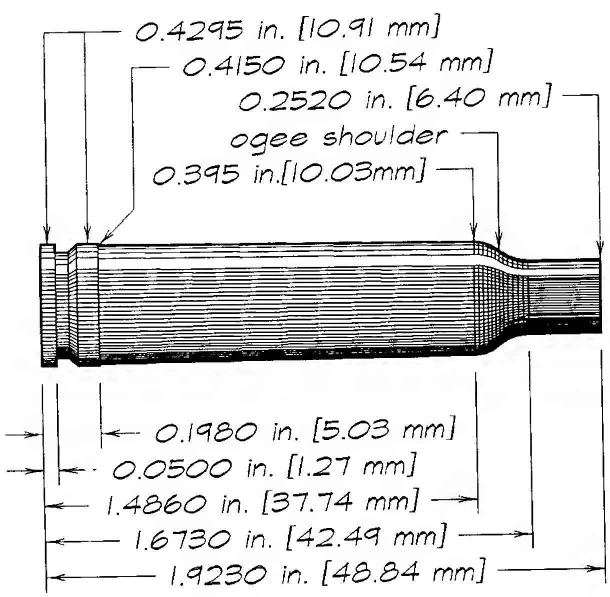
solid:
426 gr brass
50 gr water

.224 bullet displaces 9.97 grains per inch.

Form from .225 Winchester brass, in RCBS form and trim dies. Ream neck, in RCBS ream die. Deburr. Fire-form with inert filler.

.224 Weatherby Magnum

(SAAMI maximums, 1986)



solid:
486 gr brass
57 gr water

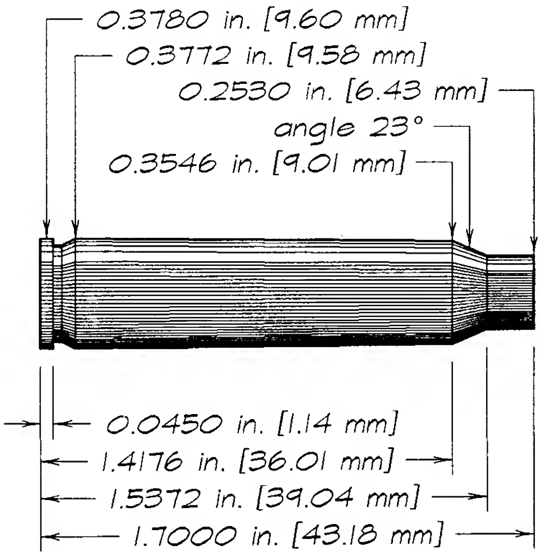
.224 bullet displaces 9.97 grains per inch.

Use factory .224 Weatherby Magnum brass.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.224 Winchester

(Winchester-Western dwg)



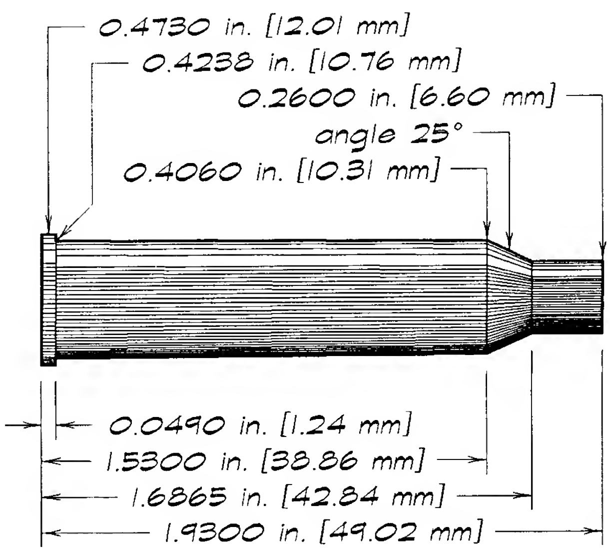
solid:
358 gr brass
42 gr water

.224 bullet displaces
9.97 grains per inch.

Resize .223 Remington brass full-length in .224 Winchester sizer die. Trim to length and deburr.

.225 Winchester

(SAAMI maximums)



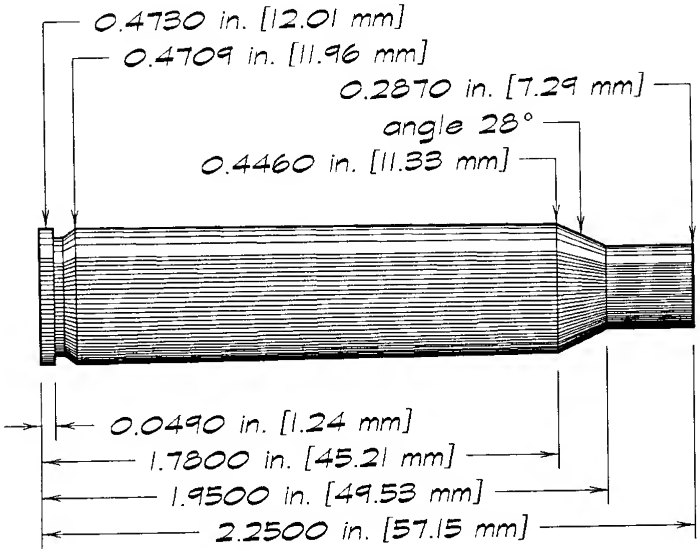
solid:
530 gr brass
62 gr water

.224 bullet displaces
9.97 grains per inch.

Good factory brass is abundant, but if .30-30 Winchester brass is more plentiful, form it in RCBS .225 Winchester form and trim dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.228 Ackley Magnum (David J LeGate)

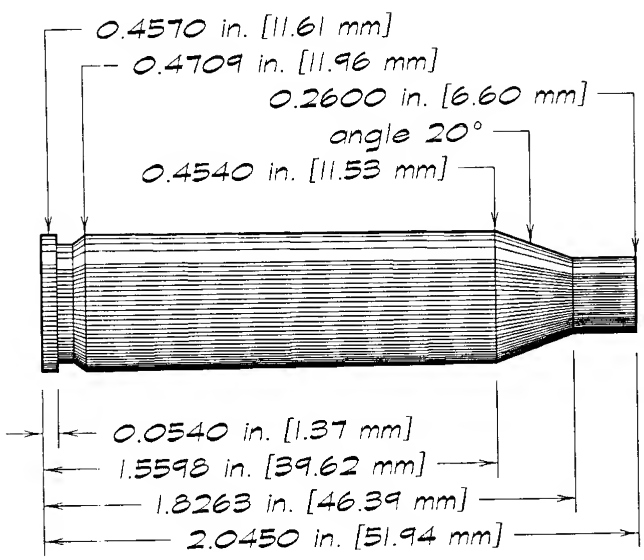


solid:
714 gr brass
84 gr water

.227 bullet displaces
10.23 grains per inch.

Resize .25-06 Remington, .270 Winchester, or .280 Remington brass full-length in .228 Ackley Magnum sizer die. Or form from .30-06 Springfield brass, in RCBS form and trim dies. Deburr. Fire-form with inert filler.

.230 LLF (SAAMI, specimen round)



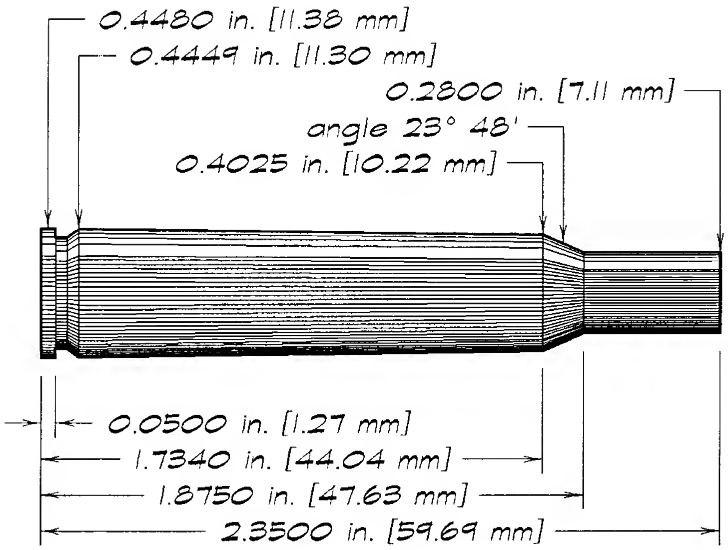
solid:
594 gr brass
70 gr water

.230 bullet displaces
10.51 grains per inch.

Resize .243 Winchester brass full-length in .230 LLF sizer die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.236 USN (6mm Navy, 6mm Lee Navy) (David J LeGate, et alii)

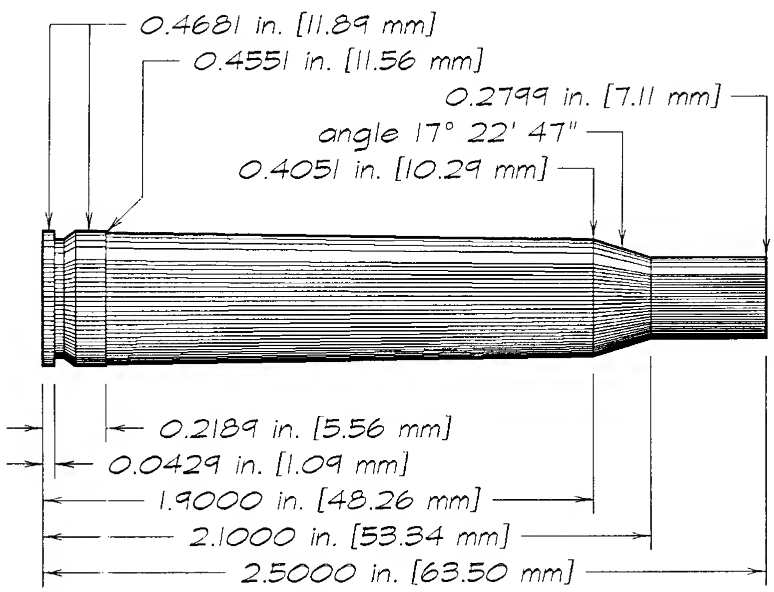


solid:
629 gr brass
74 gr water

.244 bullet displaces
11.82 grains per inch.

There's no satisfactory substitute for this case, as far as I know. If the need is worth the trouble, it's possible to turn the bases of .220 Swift brass to .236 Navy dimensions and come up with a short-neck version of the .236 Navy case.

.240 Belted Rimless Nitro Express (CIP maximums)



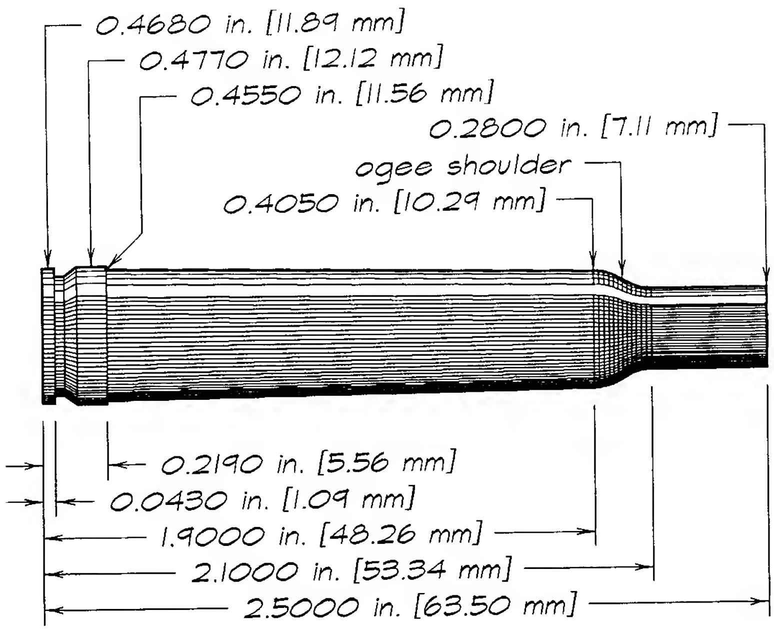
solid:
717 gr brass
84 gr water

.245 bullet displaces
11.92 grains per inch.

Use factory .240 Belted Rimless NE brass. Or anneal neck and shoulder of .270 Winchester or .30-06 Springfield brass, and form in special RCBS form-die set -- belt-forming dies with solid shell-holder, form dies, trim die, and neck-ream die -- according to the detailed instructions that come with the special die set.
Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.240 Belted Rimless Nitro Express

(ICI Metals Ltd dwg)



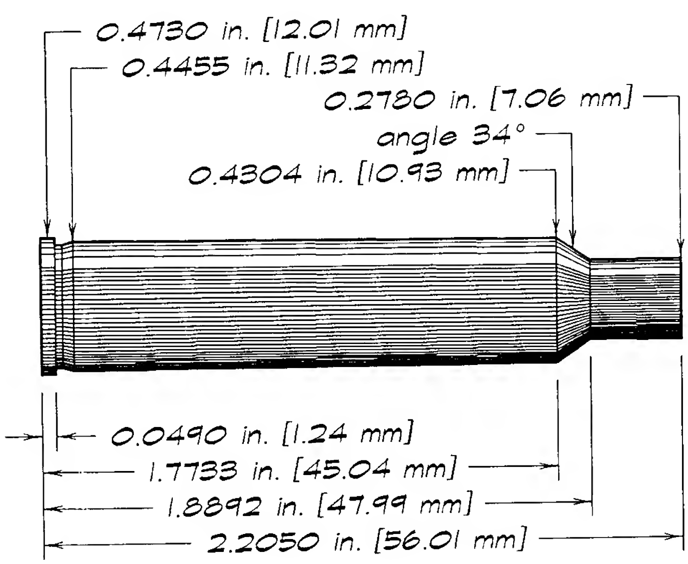
solid:
720 gr brass
84 gr water

.245 bullet displaces
11.92 grains per inch.

Use factory .240 Belted Rimless NE brass. Or anneal .270 Winchester or .30-06 Springfield brass and form belt, in special RCBS form-die set. Form and trim in RCBS form and trim dies. Ream inside neck, in RCBS neck-ream die. Deburr.

.240 Cobra

(F K Elliott drawing)



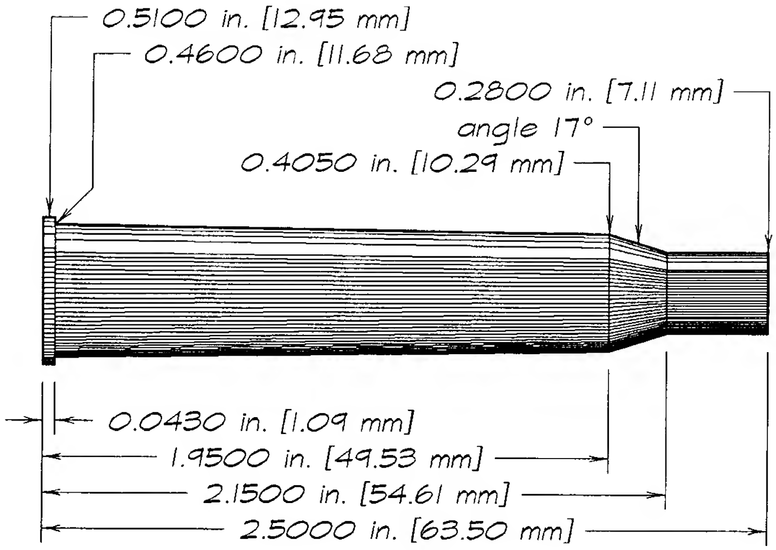
solid:
675 gr brass
79 gr water

.243 bullet displaces
11.73 grains per inch.

Fire-form .220 Swift brass with inert filler. NOTE: there are several versions of this cartridge, with significantly different dimensions. Send a chamber cast and/or several fired, unsized empty cases to Huntington Die Specialties (P O Box 991 Oroville, CA 95965) for dies custom-made to fit your chamber.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.240 Flanged Nitro Express (Birmingham Proof House)

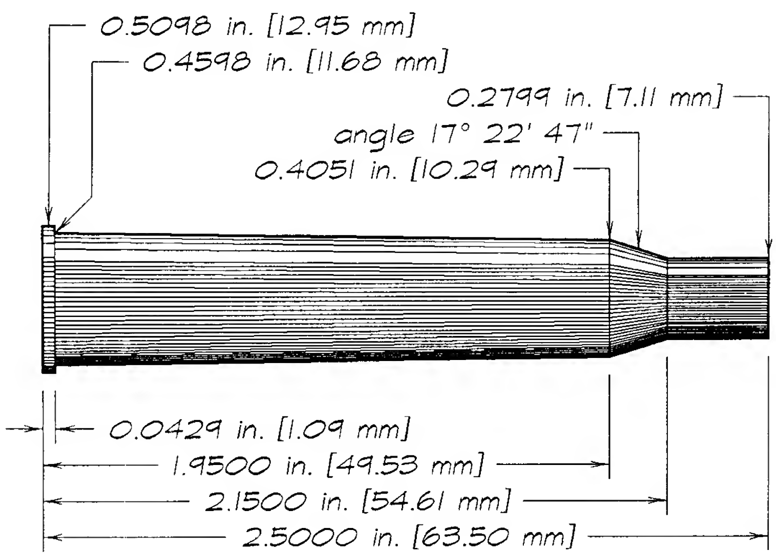


solid:
721 gr brass
85 gr water

.245 bullet displaces
11.92 grains per inch.

Use factory .240 Fl NE brass. Or form from 9.3x74mm Rimmed brass, in RCBS form and trim dies.

.240 Flanged Nitro Express (CIP maximums)



solid:
720 gr brass
84 gr water

.249 bullet displaces
12.31 grains per inch.

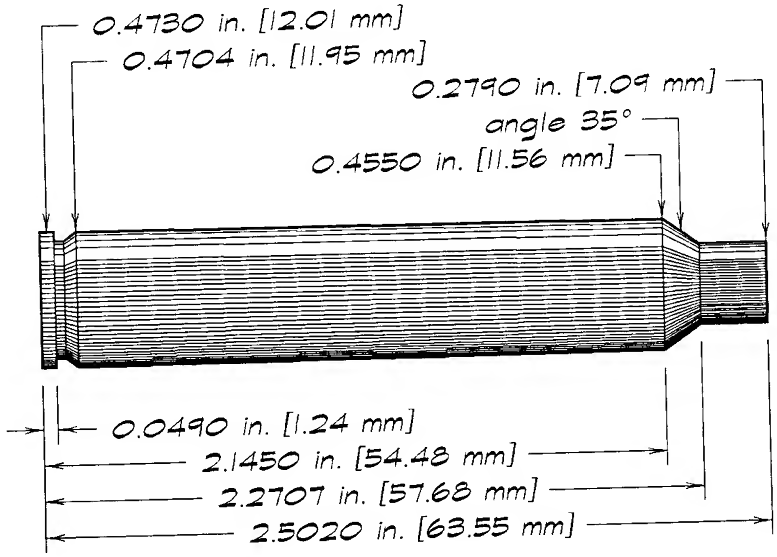
Use factory .240 Fl. NE brass. Or form from 9.3x74mm Rimmed brass, in RCBS form and trim dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.240 Gibbs

(David J LeGate)

solid:
831 gr brass
98 gr water



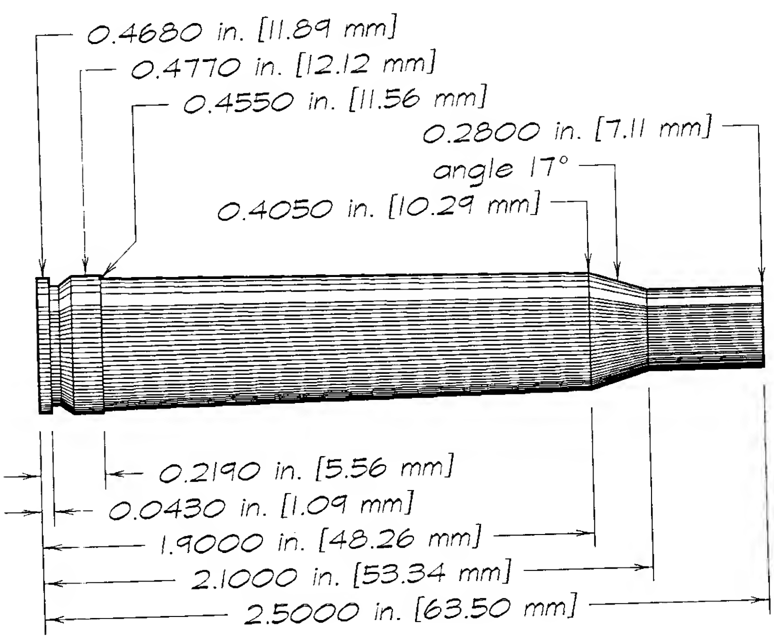
.243 bullet displaces
11.73 grains per inch.

Form from .25-06 Remington, .270 Winchester, .280 Remington, or .30-06 Springfield brass in RCBS .240 Gibbs form die. Resize full-length in .240 Gibbs sizer die. Fire-form with inert filler.

.240 Holland Belted

(Kynoch drawing)

solid:
720 gr brass
84 gr water

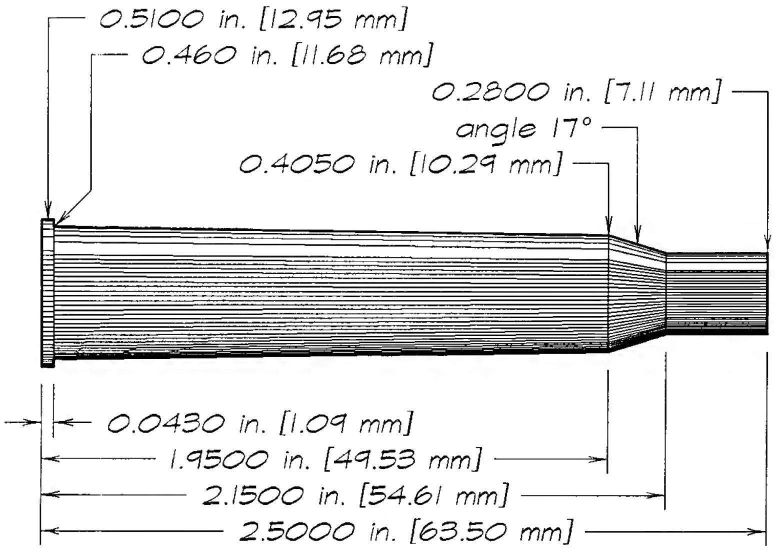


.245 bullet displaces
11.92 grains per inch.

Resize .264 Winchester Magnum brass full-length in .240 Holland Belted sizer die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.240 Holland Flanged (Eley drawing)

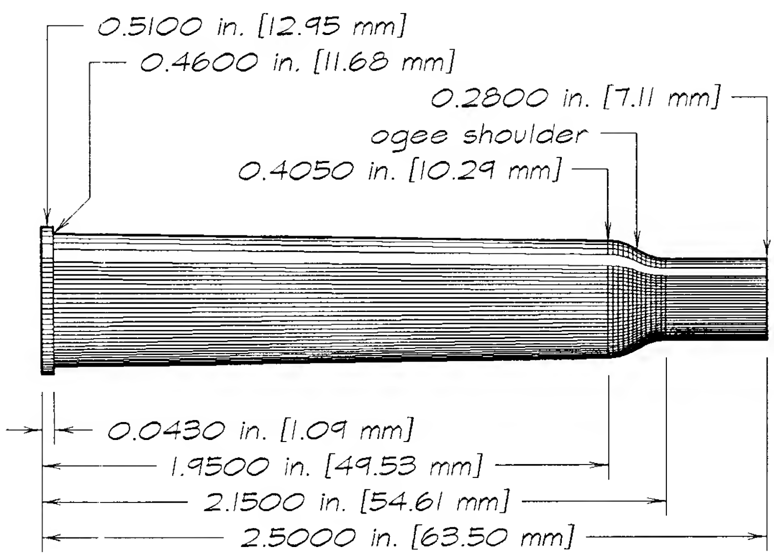


solid:
721 gr brass
85 gr water

.245 bullet displaces
11.92 grains per inch.

Use factory .240 Flanged brass. Or form from 9.3x74mm Rimmed brass, in RCBS form and trim dies. Ream neck, in RCBS neck-ream die.

.240 Holland & Holland Flanged (ICI Metals Ltd dwg)



solid:
722 gr brass
85 gr water

.245 bullet displaces
11.92 grains per inch.

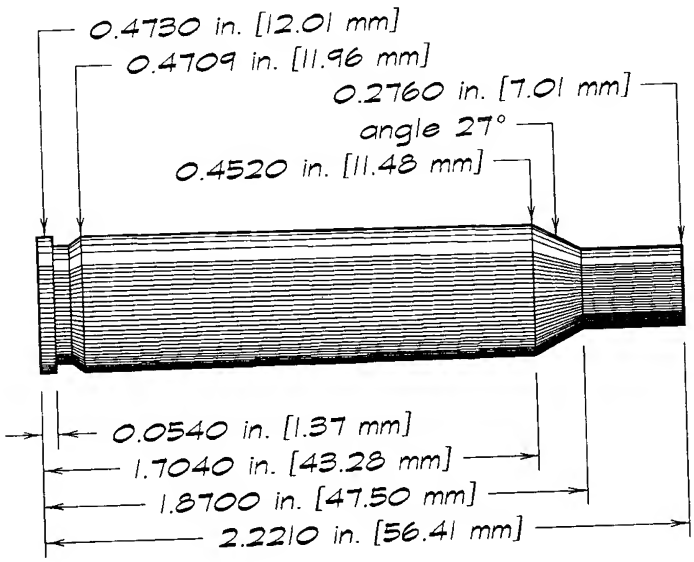
Use factory .240 Flanged brass. Or form from 9.3x74mm Rimmed brass, in RCBS form and trim dies. Ream neck, in RCBS neck-ream die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.240 PSP

(Speer manual number 4)

solid:
692 gr brass
81 gr water



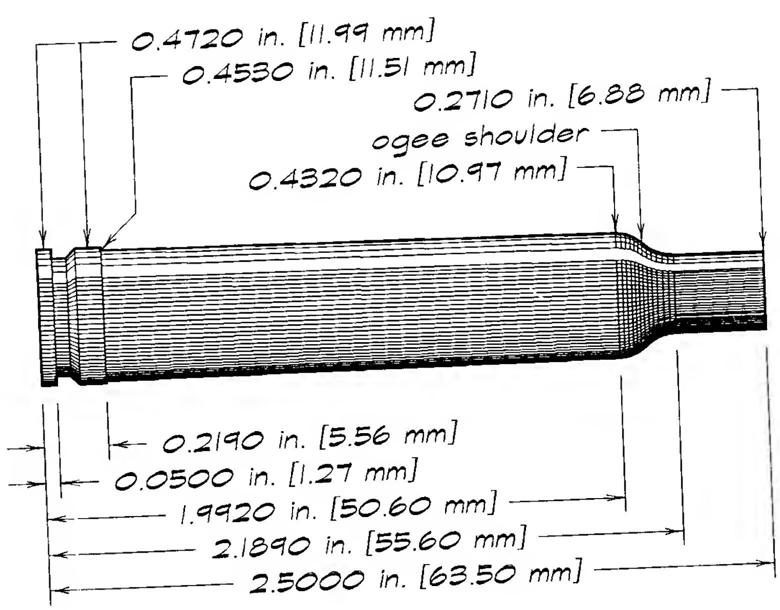
..243 bullet displaces
11.73 grains per inch.

Anneal neck and shoulder of .308 Winchester brass. Form in RCBS form dies.

.240 Weatherby Magnum

(SAAMI maximums, 1986)

solid:
768 gr brass
90 gr water



.243 bullet displaces
11.73 grains per inch.

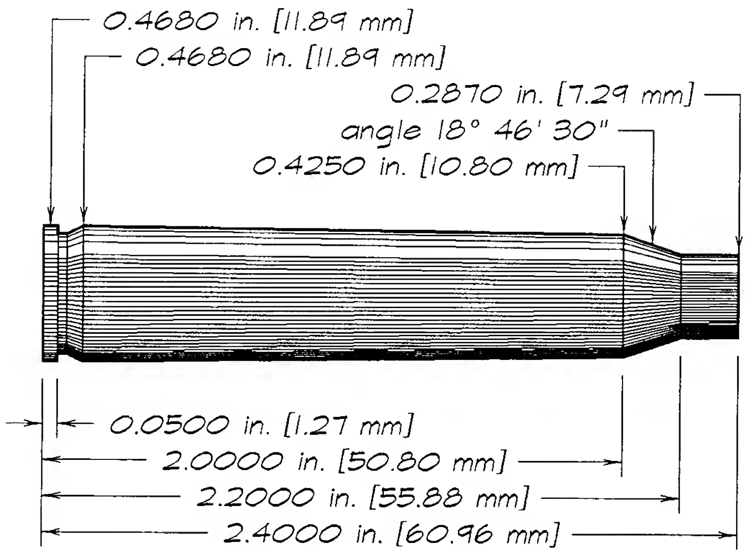
This case definitely needs the RCBS belt-forming die, to swage a belt onto .25-06, .270, .280, or .30-06 brass, and form dies. Fire-form with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.242 Vickers

(Kynoch drawing, 1922)

solid:
761 gr brass
89 gr water



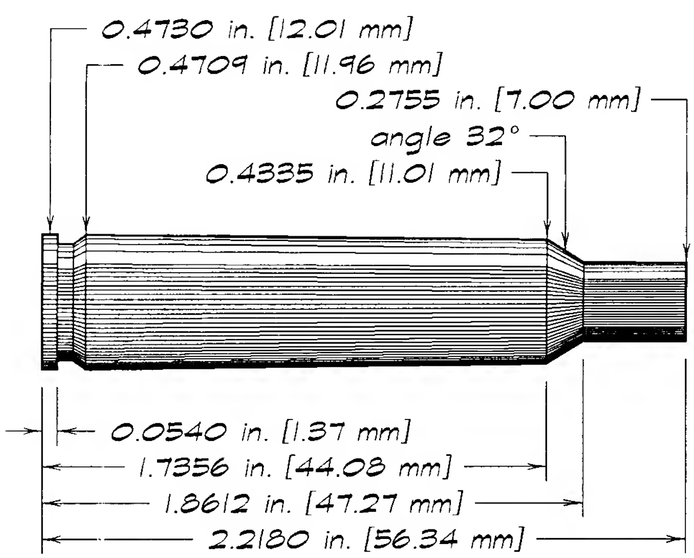
.249 bullet displaces
12.31 grains per inch.

Resize .25-06 Remington brass full-length in .242 Vickers sizer die. Trim to 2.4 inches. Deburr.

.243 Rockchucker

(F K Elliott drawing)

solid:
683 gr brass
80 gr water



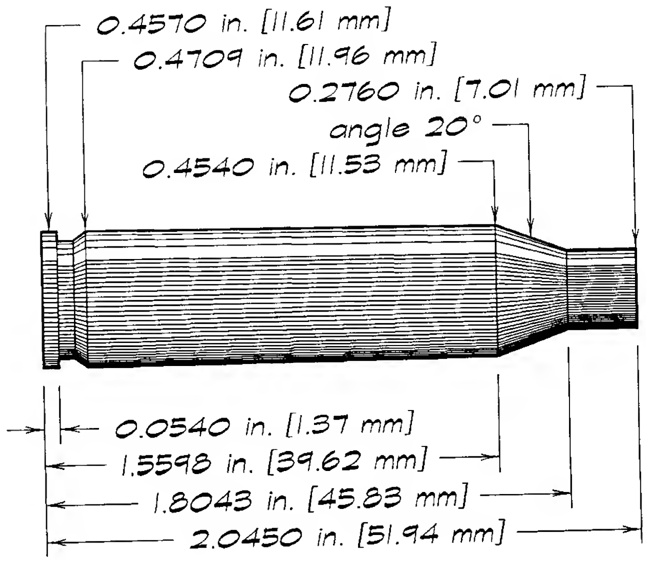
.243 bullet displaces
11.73 grains per inch.

Use 6mm Remington brass -- pedigreed puppy of this Fred Huntington design.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.243 Winchester

(SAAMI maximums)



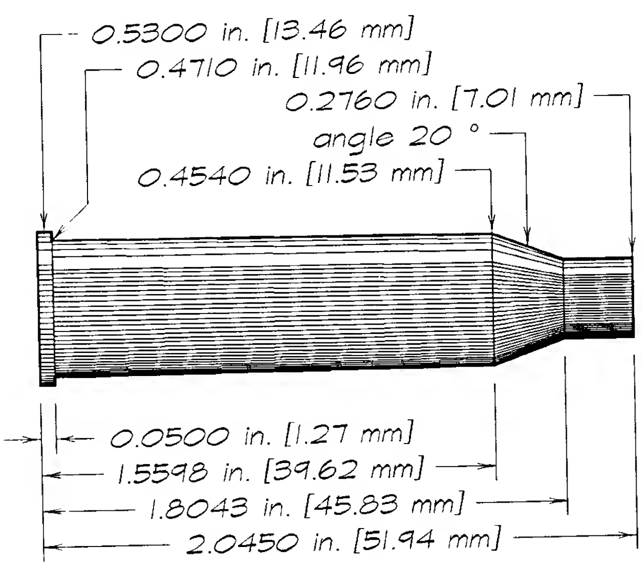
solid:
646 gr brass
76 gr water

.243 bullet displaces
11.73 grains per inch.

There's plenty of factory brass out there for this one, but you can also form it from its parent .308 Winchester case, or from 6mm Remington brass, or even from .30-06 brass, in the respective RCBS form dies.

.243 Winchester Rimmed

(designer's specs)



solid:
677 gr brass
79 gr water

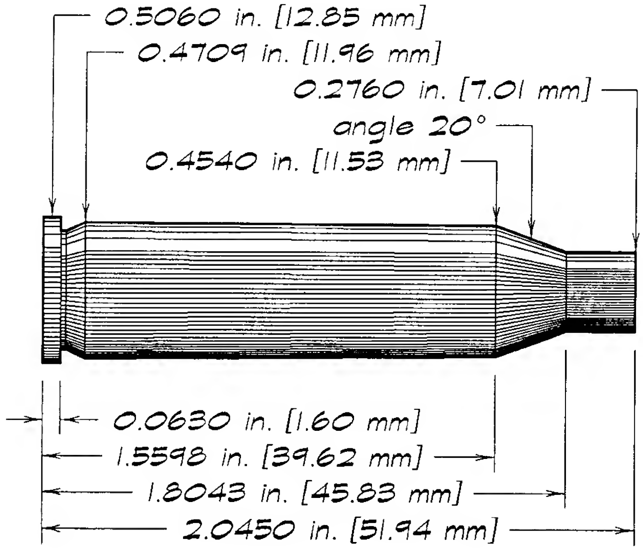
.243 bullet displaces
11.73 grains per inch.

Anneal shoulder and upper body of .307 Winchester or .400-.350 NE brass. Form and trim in RCBS form and trim dies. Ream neck, in RCBS neck-ream die. Deburr.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.243-.307 Wilson

(designer's specs)



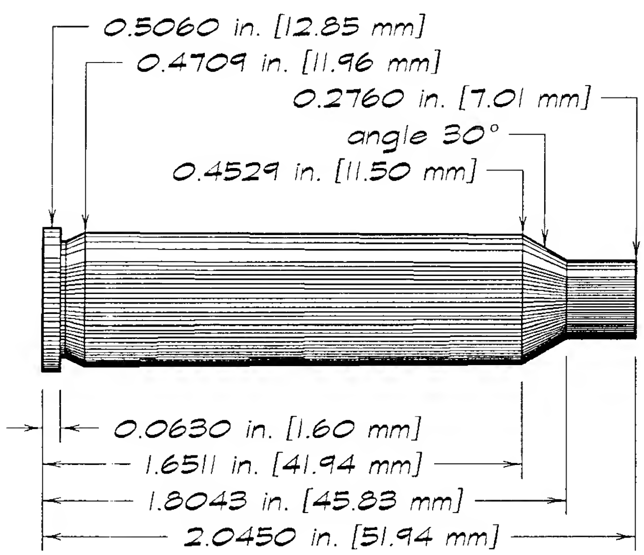
solid:
636 gr brass
75 gr water

.243 bullet displaces 11.73 grains per inch.

Anneal neck and shoulder of .307 Winchester brass and resize full-length in .243-.308 Wilson sizer die. Ream inside neck if necessary.

.243-.307 Wilson Improved

(designer's specs)



solid:
703 gr brass
82 gr water

.243 bullet displaces 11.73 grains per inch.

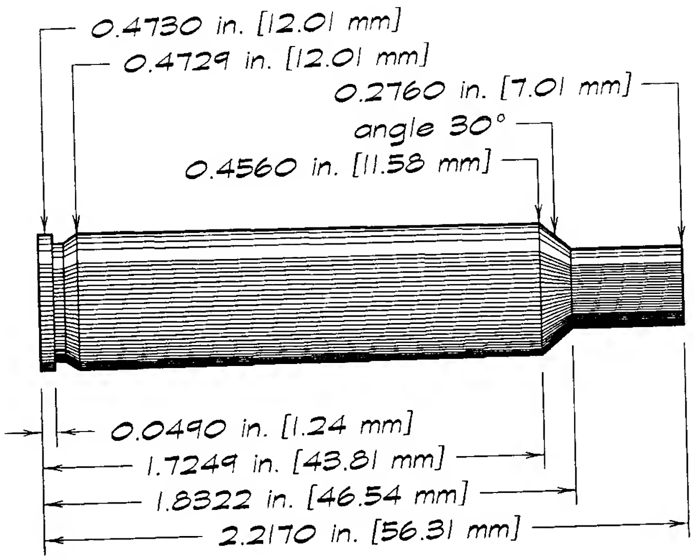
Anneal neck and shoulder of .307 Winchester brass and resize full-length in .243-.308 Wilson Improved sizer die. Fire-form with inert filler. Ream neck if necessary.

Anneal only by method shown in text. ***Text explains use of "solid" and displacement figures.***

.244 Ackley Improved

(Speer manual number 4)

solid:
695 gr brass
82 gr water



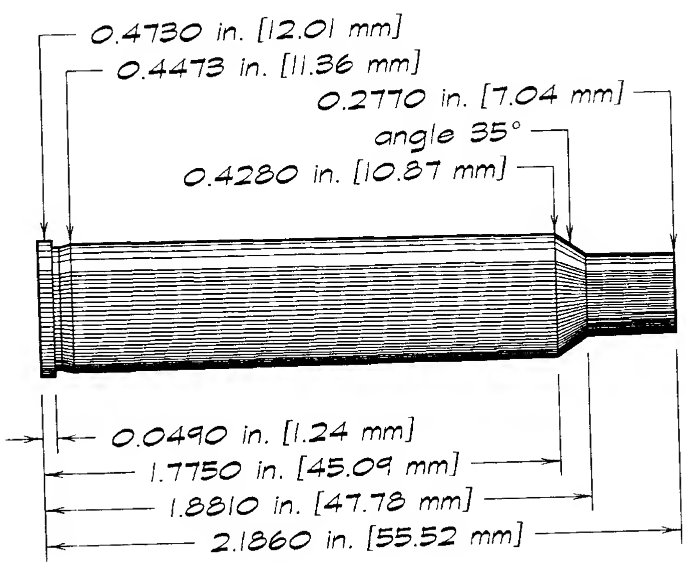
.243 bullet displaces
11.73 grains per inch.

Fire-form 6mm (.244) Remington brass with inert filler. Or fire 6mm (.244) Remington ammo in "Improved" chamber.

.244 Gipson

(David J LeGate)

solid:
670 gr brass
79 gr water



.243 bullet displaces
11.73 grains per inch.

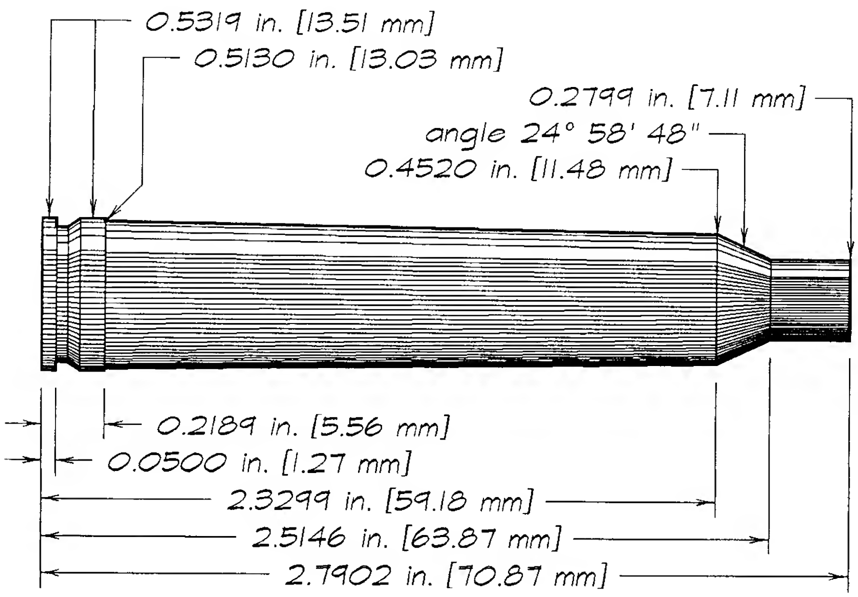
Anneal neck and shoulder of .220 Swift brass and fire-form with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.244 H&H Magnum

(CIP maximums)

solid:
1,044 gr brass
123 gr water



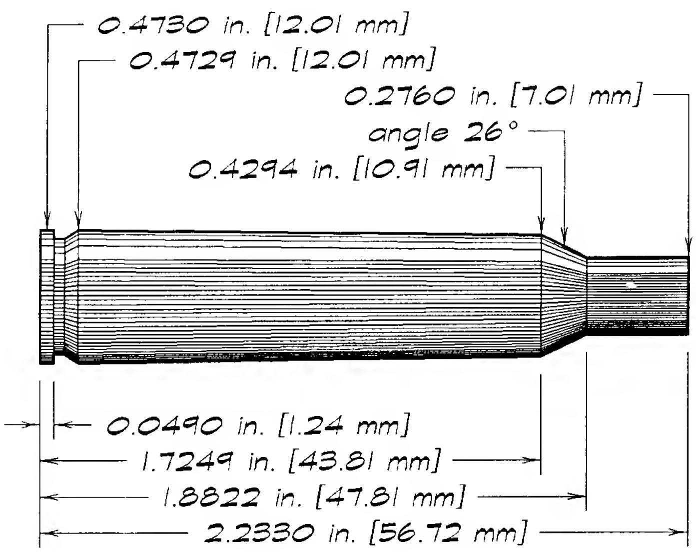
.245 bullet displaces
11.92 grains per inch.

Use factory .244 H&H Magnum brass. Or form from .300 H&H Magnum or .375 H&H Magnum brass, in RCBS form and trim dies. Ream neck, in RCBS neck-ream die.

.244 Remington

(SAAMI maximums)

solid:
683 gr brass
80 gr water



.243 bullet displaces
11.73 grains per inch.

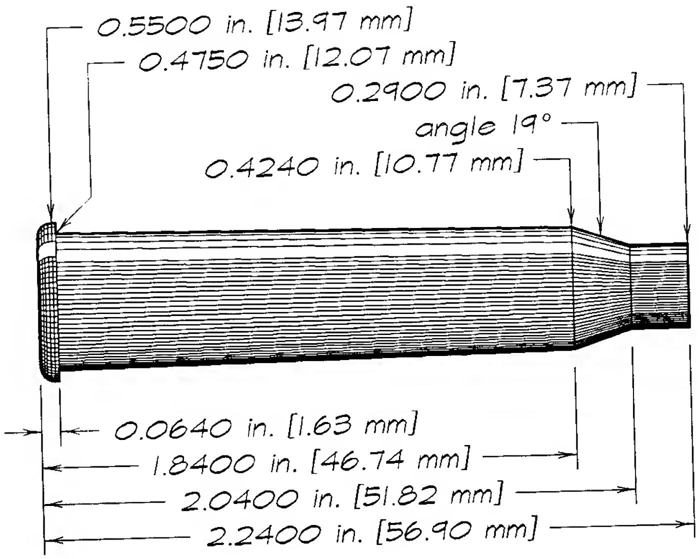
Recently made factory brass should be plentiful and easy to find. If necessary, form from any .30-06-based case that's long enough. Fire-form with inert filler to expand case, or resize full-length in 6mm Remington sizer die to swage down.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.246 Purdey

(Kynoch drawing, 1921)

solid:
706 gr brass
83 gr water



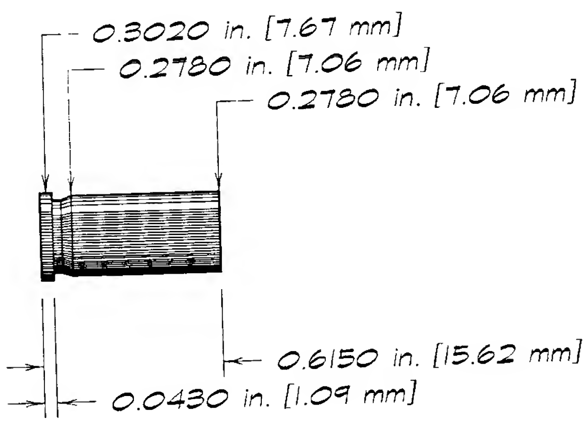
.252 bullet displaces
12.61 grains per inch.

Anneal neck, shoulder, and upper body of .400-.350 NE brass. Resize full-length in .246 Purdy sizer (to headspace on SHOULDER, not rim -- resize until breech closes on resized case). Trim to 2.24 inches. Deburr. Fire-form with inert filler.

.25 Automatic (.25 ACP)

(SAAMI maximums)

solid:
86 gr brass
10 gr water

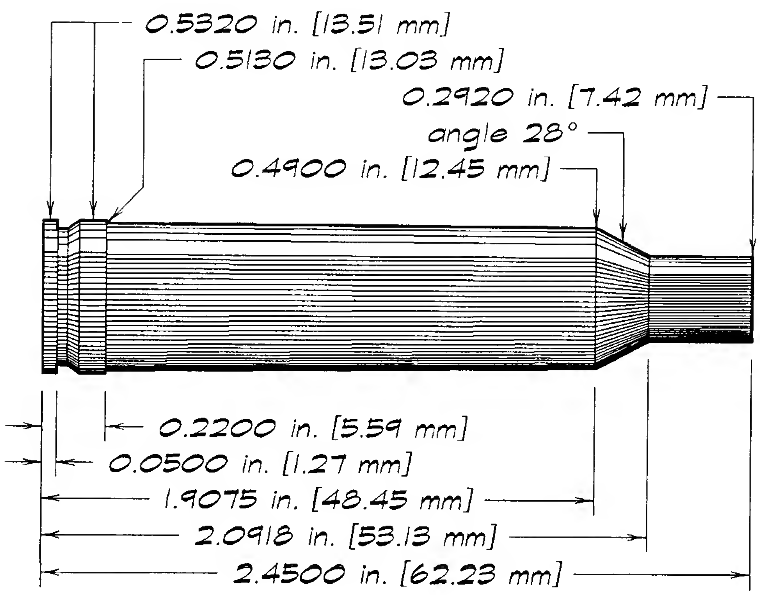


.251 bullet displaces
12.51 grains per inch.

Use factory .25 Auto brass. That's all there is. There's no substitute.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.25 Ackley Magnum (Speer manual number 4)

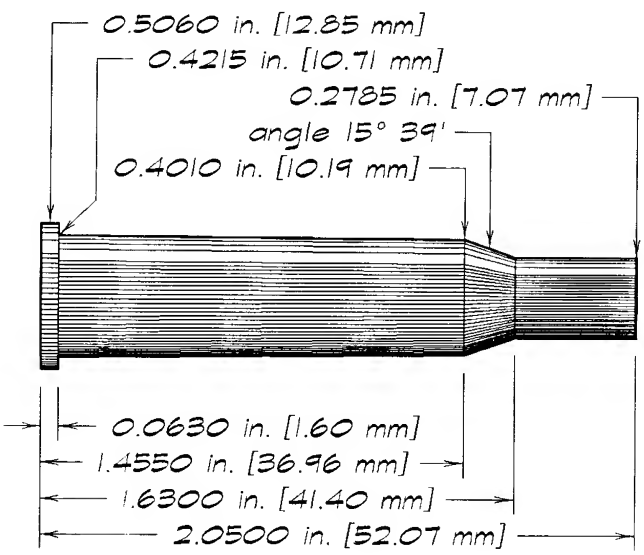


solid:
945 gr brass
111 gr water

.257 bullet displaces
13.12 grains per inch

Anneal neck and shoulder of .264 or .300 Winchester Magnum or 7mm Remington Magnum brass. Resize full-length in .25 Ackley Magnum sizer die. Fire-form with inert filler, trim, and deburr.

.25 Bullberry (David J LeGate)



solid:
516 gr brass
61 gr water

.258 bullet displaces
13.22 grains per inch.

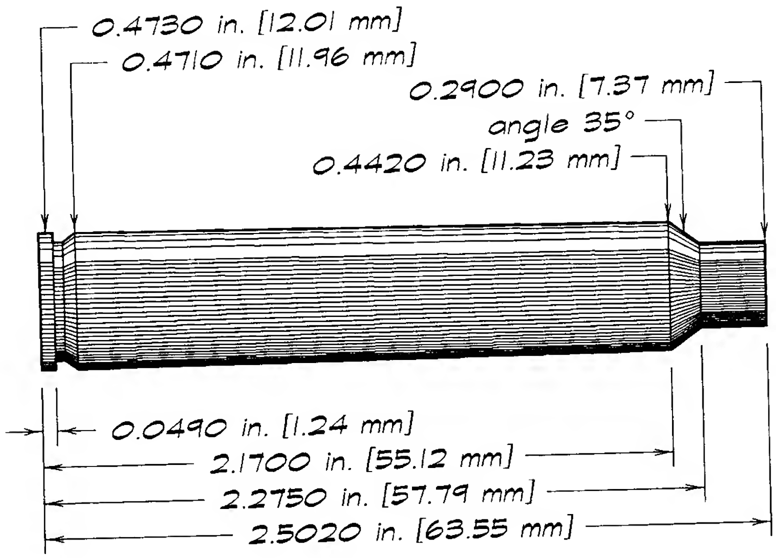
Form from .30-30 Winchester brass, in RCBS form-and-trim die. Fire-form with inert filler. Ream inside necks if necessary.

Anneal only by method shown in text.   Text explains use of "solid" and displacement figures.

.25 Gibbs

(David J LeGate)

solid:
826 gr brass
97 gr water



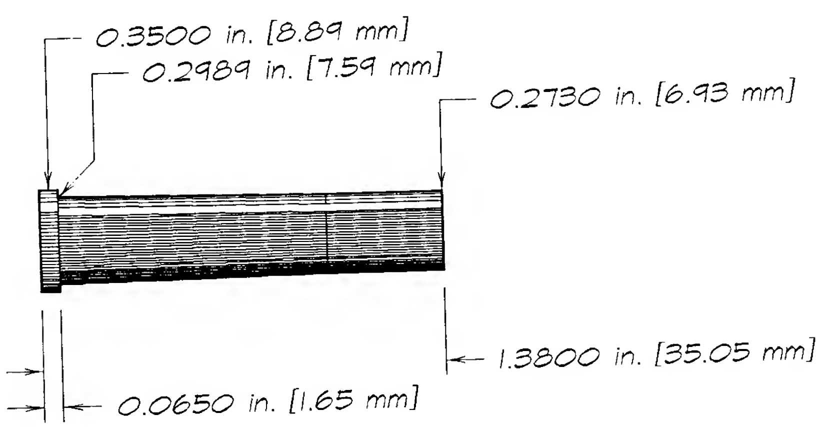
.257 bullet displaces
13.12 grains per inch.

Resize .270 Winchester, .280 Remington, .30-06 Springfield, or .35 Whelen brass full-length in .25 Gibbs sizer die. Fire-form with inert filler. Ream inside necks, if necessary, in RCBS neck-ream die. Some chambers may require trimming cases to 2.49 inches.

.25 Hornet

(David J LeGate)

solid:
176 gr brass
21 gr water

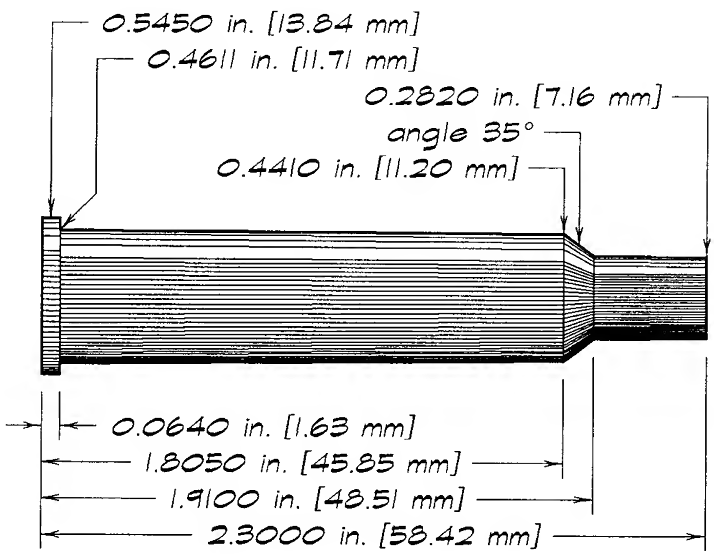


.257 bullet displaces
13.12 grains per inch

Fire-form .22 Hornet brass (preferably RWS) with inert filler.

Anneal only by method shown in text. **Text explains use of "solid" and displacement figures.**

.25 Krag Improved (David J LeGate)

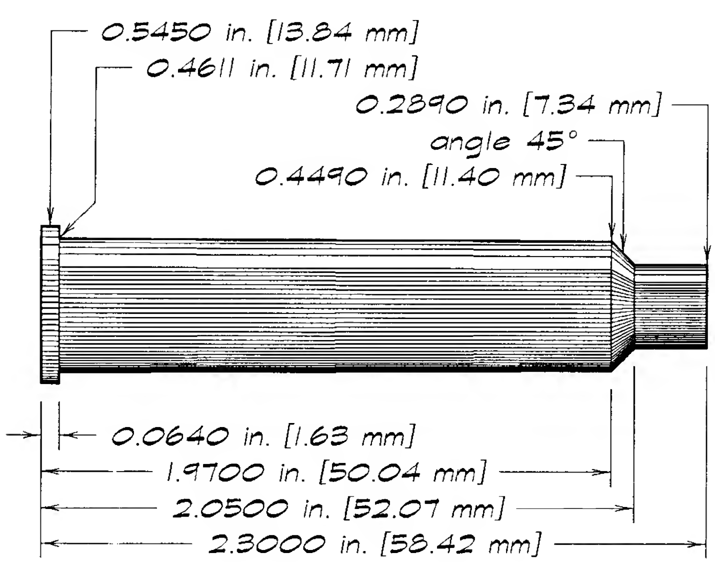


solid:
692 gr brass
81 gr water

.257 bullet displaces
13.12 grains per inch.

Form from .30-40 Krag brass, in RCBS form dies.

.25 Krag-Newton (Davis version 4) (designer's specs)



solid:
730 gr brass
86 gr water

.257 bullet displaces
13.12 grains per inch.

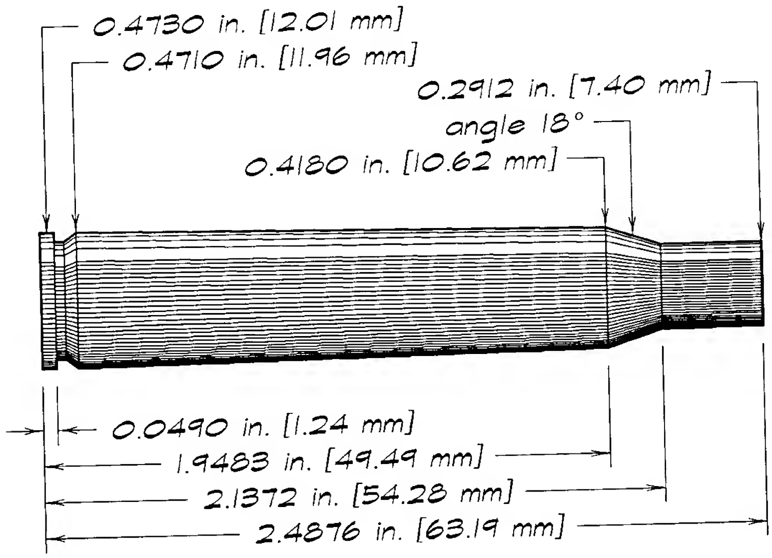
Anneal neck, shoulder, and upper body of .30-40 Krag brass. Form in RCBS form dies. Fire-form with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.25 Newton

(Newton drawing*)

solid:
762 gr brass
89 gr water



.257 bullet displaces
13.12 grains per inch.

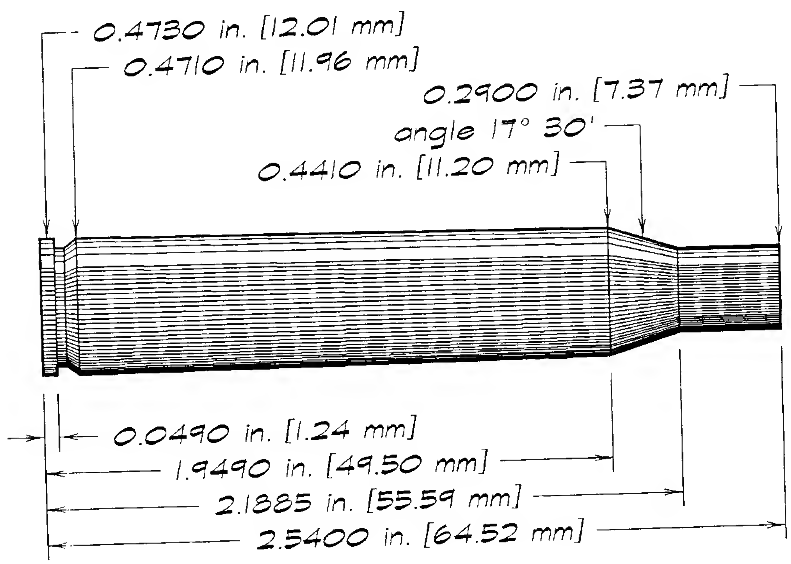
Resize .25-06 Remington brass full-length in .25 Newton sizer die. Or from from .280 Remington or .30-06 Springfield brass, in RCBS form-and-trim dies.

*derived from Newton factory dimensions for .25 Newton chamber

.25 Niedner

(Speer manual number 4)

solid:
794 gr brass
93 gr water

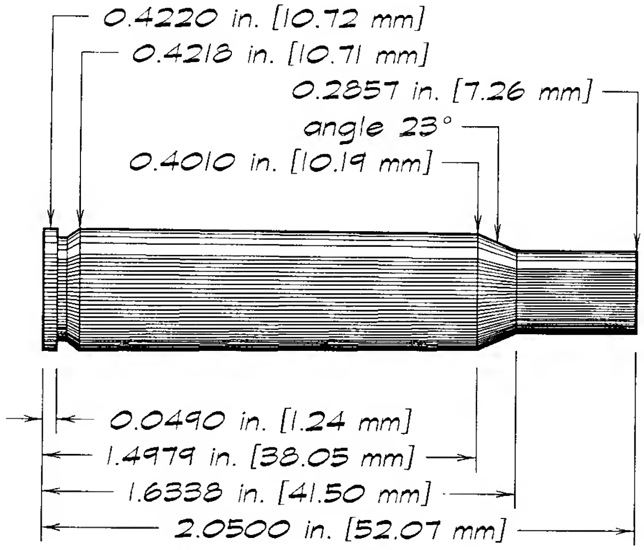


.257 bullet displaces
13.12 grains per inch.

Resize .270 Winchester or .280 Remington brass full-length in .25 Niedner sizer die. Or use .25-06 Remington brass if the shorter neck is acceptable.

Anneal only by method shown in text. *Text explains use of "solid" and displacement figures.*

.25 Remington (SAAMI maximums, 1967)

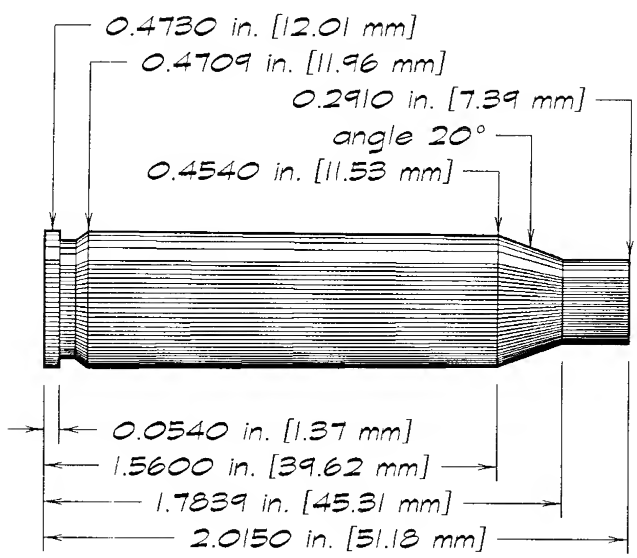


solid:
503 gr brass
59 gr water

.259 bullet displaces
13.32 grains per inch.

Form from .30 or .32 Remington brass, in RCBS form dies.

.25 Souper (Speer manual number 4)



solid:
644 gr brass
76 gr water

.257 bullet displaces
13.12 grains per inch.

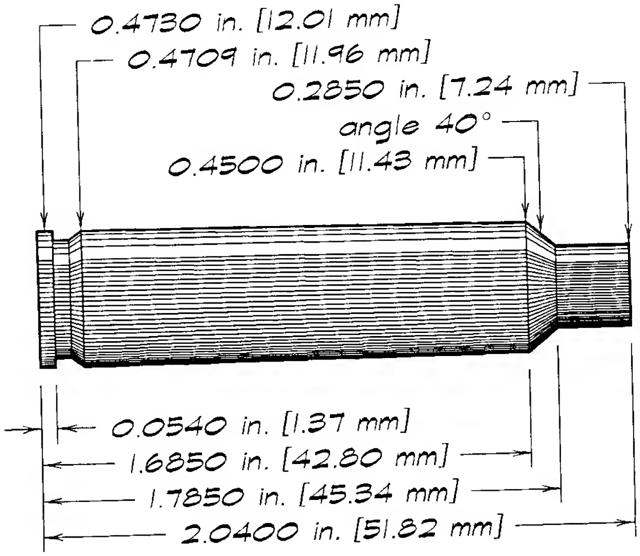
Anneal neck of .308 Winchester brass and form in RCBS form dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.25 Souper Improved

(fire-formed case)

solid:
658 gr brass
77 gr water



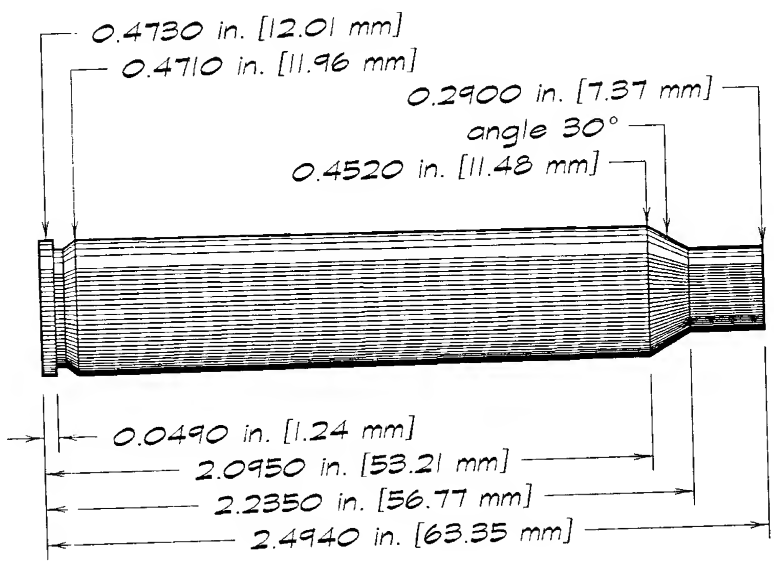
.257 bullet displaces
13.12 grains per inch.

Fire-form .243 Winchester brass with inert filler.

.25-06 Max M

(designer's specs)

solid:
821 gr brass
96 gr water

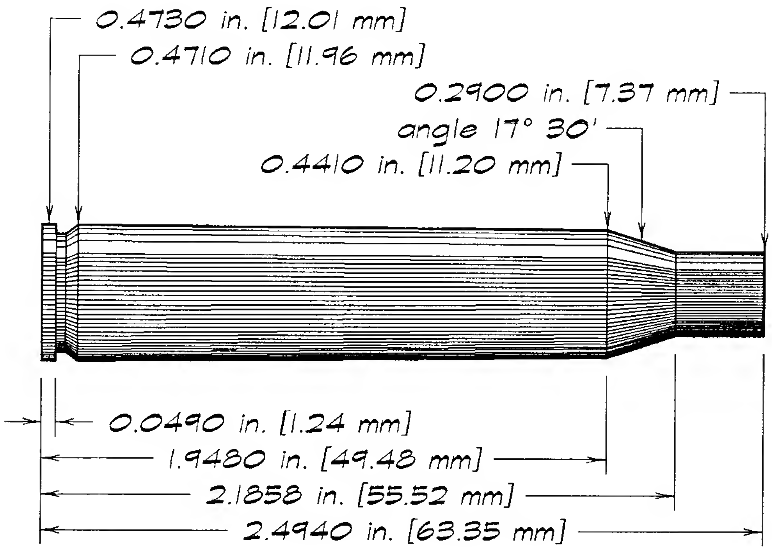


.257 bullet displaces
13.12 grains per inch.

Anneal neck, shoulder, and upper body of .30-06 Springfield, .270 Winchester, or .280 Remington brass. Resize full-length in .25-06 Max M sizer die. Fire-form with inert filler. Trim to 2.49 inches and deburr. Ream inside neck if necessary.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.25-06 Remington (SAAMI maximums)

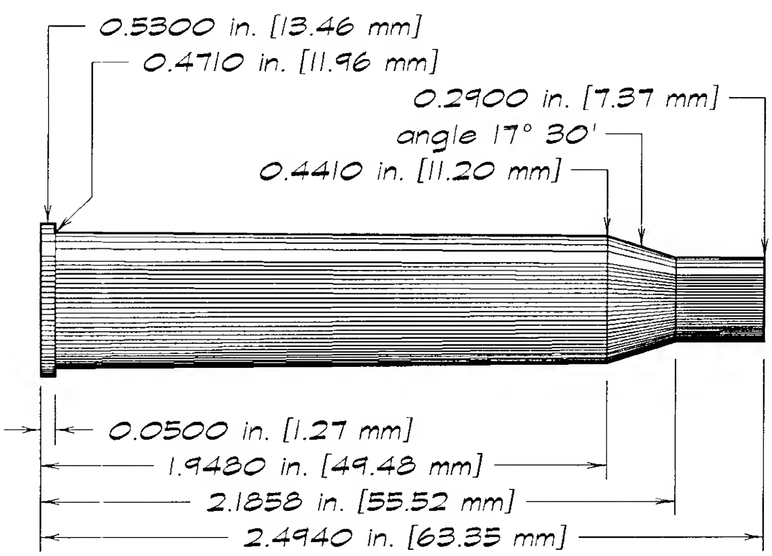


solid:
788 gr brass
92 gr water

.257 bullet displaces 13.12 grains per inch.

Factory brass should be easy to get. Or resize .270 Winchester brass full-length in .25-06 sizer die, trim to length, and deburr. Or form from .280 Remington or .30-06 Springfield brass, in RCBS form die.

.25-06 Rimmed (designer's specs)



solid:
735 gr brass
86 gr water

.257 bullet displaces 13.12 grains per inch.

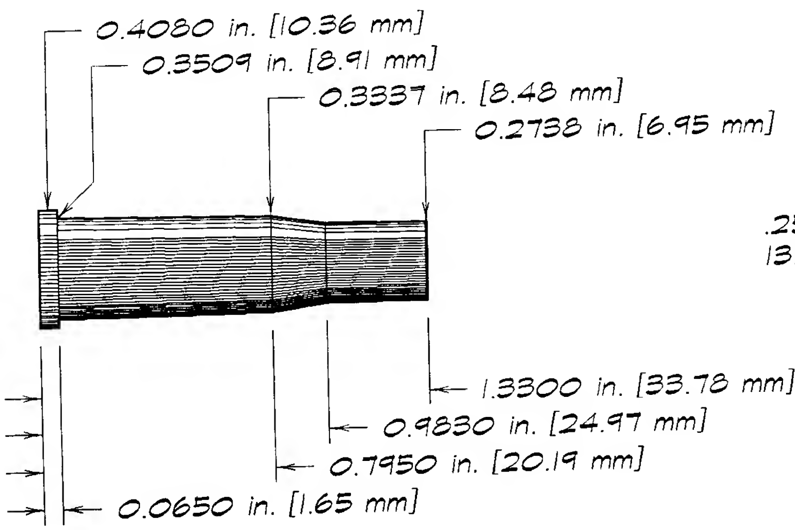
Trim .400-.350 NE brass to 2½ inches and form in RCBS form-and-trim die. Fire-form with inert filler, trim to 2.49 inches, and deburr.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.25-20 Marlin

(Winchester drawing, 1911)

solid:
227 gr brass
27 gr water



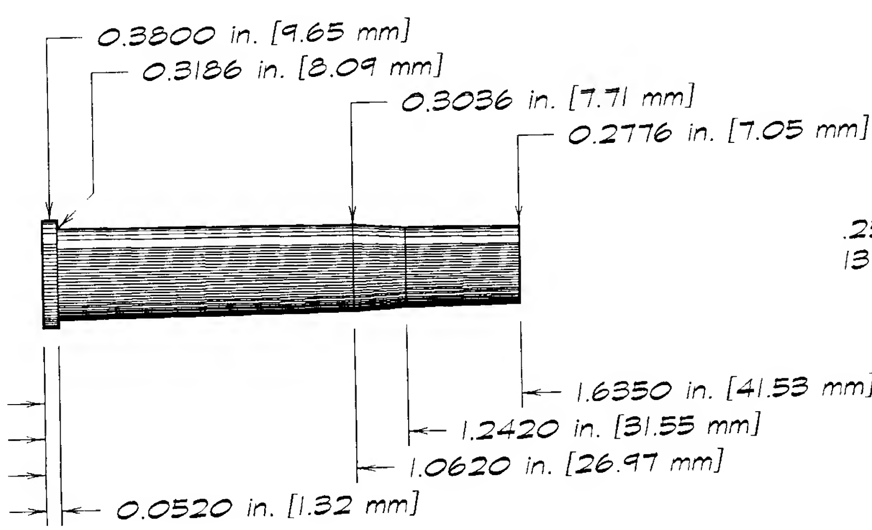
.258 bullet displaces
13.22 grains per inch.

Size .25-20 Winchester case in .25-20 Marlin die and fire-form in .25-20 Marlin chamber. Just don't confuse either the .25-20 Marlin or .25-20 Winchester with the .25-20 Single-Shot, which is longer with smaller diameters.

.25-20 Single-Shot

(Winchester drawing, 1912)

solid:
256 gr brass
30 gr water



.257 bullet displaces
13.12 grains per inch.

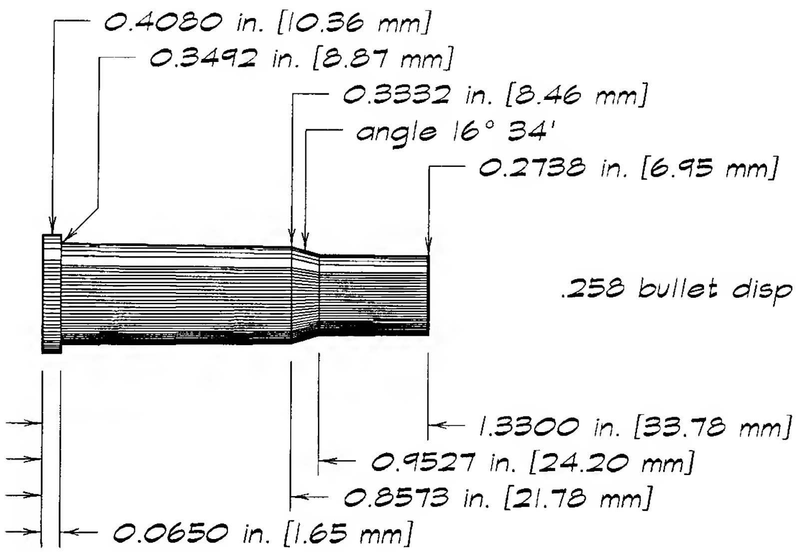
Use recently manufactured .25-20 Single-Shot brass. But DON'T try to use .25-20 Winchester brass. It's too short and too large in diameter.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.25-20 Winchester (.25 WCF)

(SAAMI maximums)

solid:
226 gr brass
26 gr water



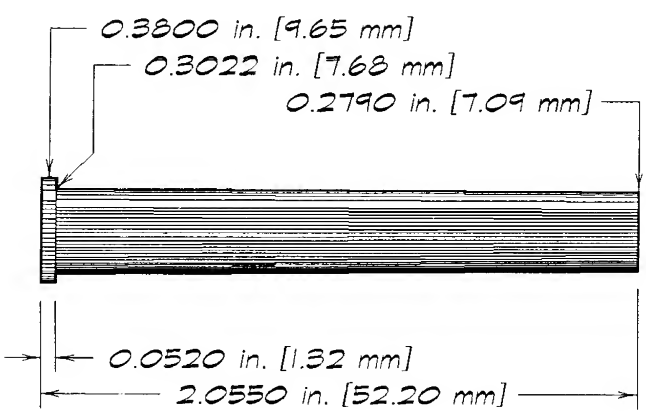
.258 bullet displaces 13.22 grains per inch.

Use recently manufactured .25-20 factory brass. Or form from .32-20 Winchester brass, in RCBS form dies.

.25-21 Stevens

(Winchester drawing, 1911)

solid:
308 gr brass
36 gr water



.257 bullet displaces 13.12 grains per inch.

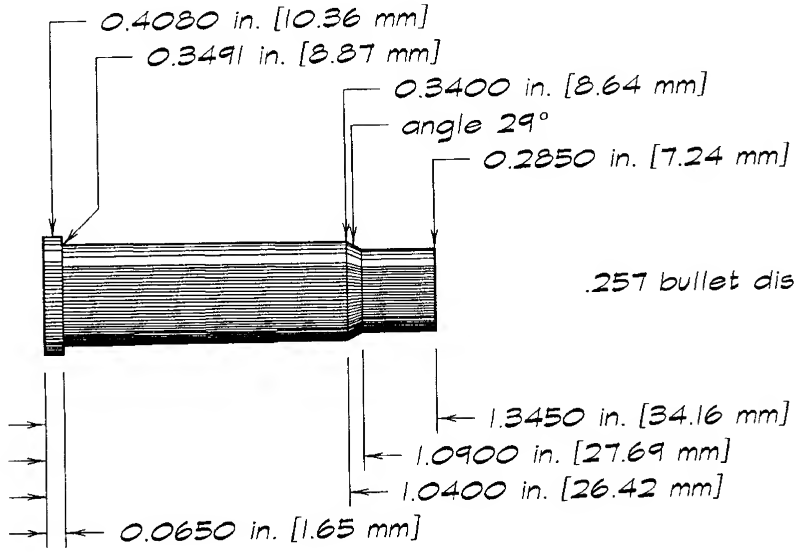
Use recently manufactured .25-21 Stevens brass. There's no completely satisfactory substitute. (Fire-formed .22 Hornet brass is too short for full loads.)

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.25-.218 Bumblebee (Howell)

(designer's specs)

solid:
248 gr brass
29 gr water



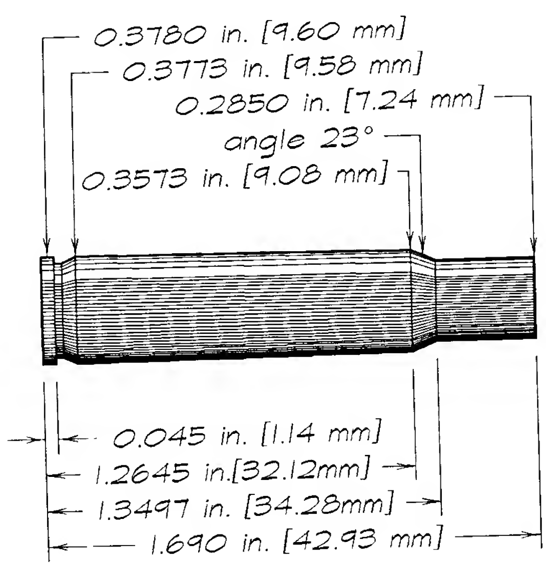
.257 bullet displaces 13.12 grains per inch.

Fire-form .218 Bee or .25-20 Winchester brass with inert filler. Or resize .32-20 Winchester brass full-length and fire-form with inert filler.

.25-.222 Copperhead

(designer's specs)

solid:
354 gr brass
42 gr water



.257 bullet displaces
13.12 grains per inch.

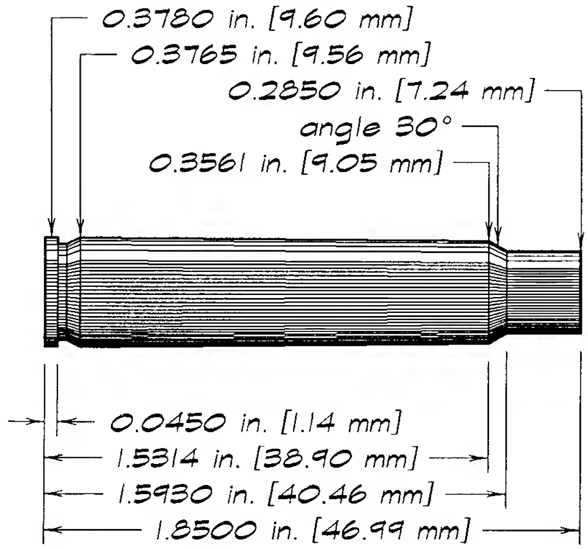
Fire-form .222 Remington brass with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.25-.222 Magnum

(designer's specs)

solid:
398 gr brass
47 gr water



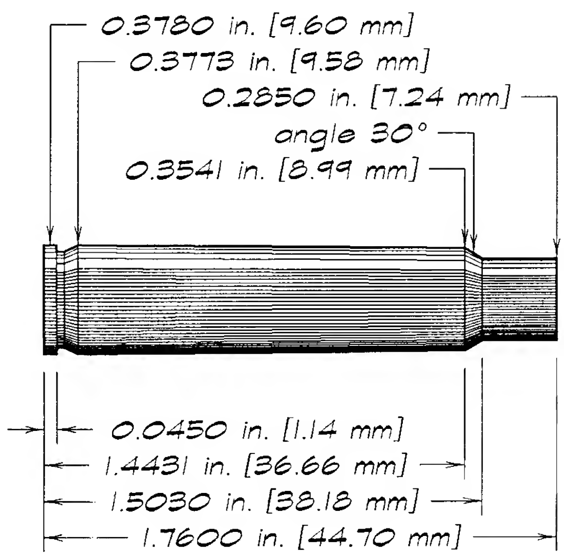
.257 bullet displaces
13.12 grains per inch.

Fire-form .222 Remington Magnum brass with inert filler.

.25-.223 Remington

(designer's specs)

solid:
377 gr brass
44 gr water



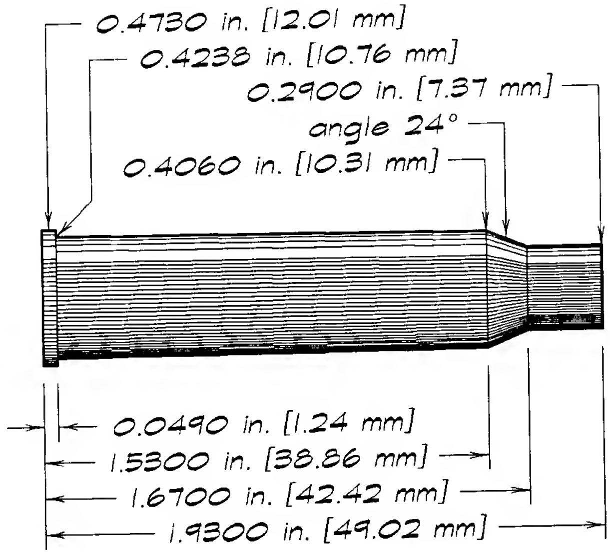
.257 bullet displaces
13.12 grains per inch.

Fire-form .223 Remington brass with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.25-.225 Winchester

(David J LeGate)



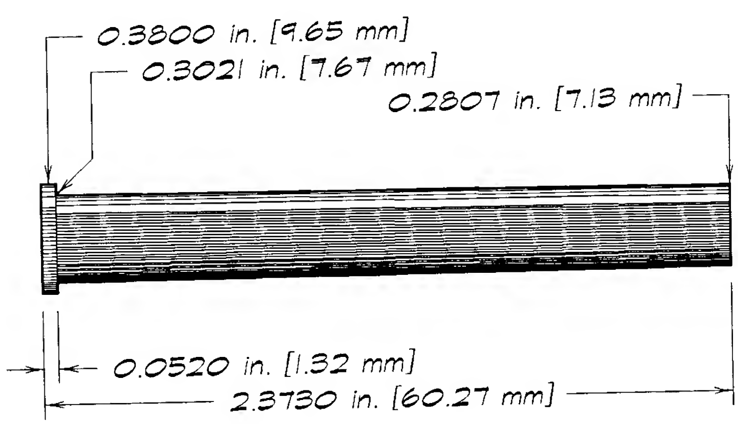
solid:
535 gr brass
63 gr water

.257 bullet displaces
13.12 grains per inch.

Fire-form .225 Winchester brass with inert filler.

.25-25 Stevens

(Winchester drawing, 1911)



solid:
358 gr brass
42 gr water

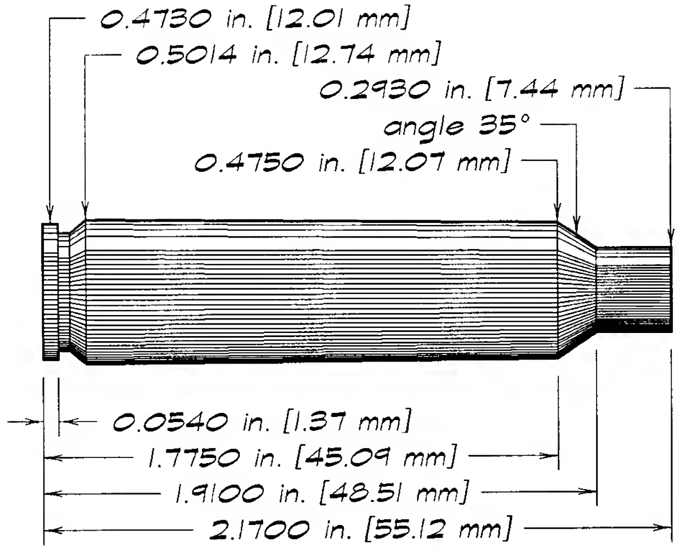
.257 bullet displaces
13.12 grains per inch.

Use recently manufactured .25-25 Stevens brass.

Anneal only by method shown in text. **Text explains use of "solid" and displacement figures.**

.25-.284 Winchester (David J LeGate)

solid:
781 gr brass
92 gr water

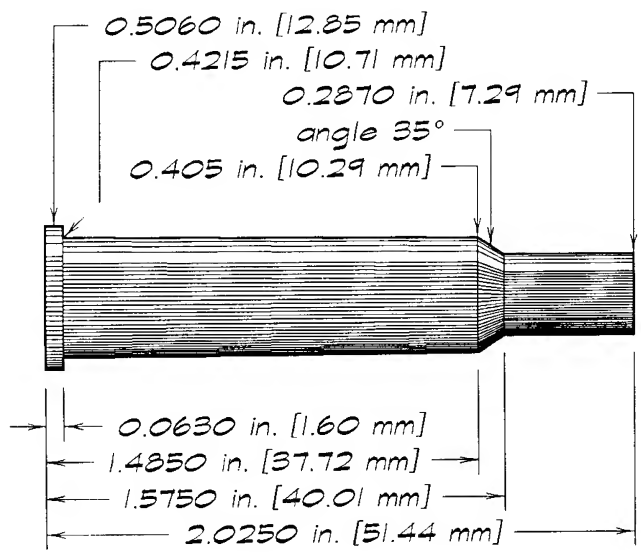


.257 bullet displaces
13.12 grains per inch.

Form from .284 Winchester brass, in RCBS form die.

.25-35 Tomcat (David J LeGate)

solid:
515 gr brass
60 gr water



.257 bullet displaces
13.12 grains per inch.

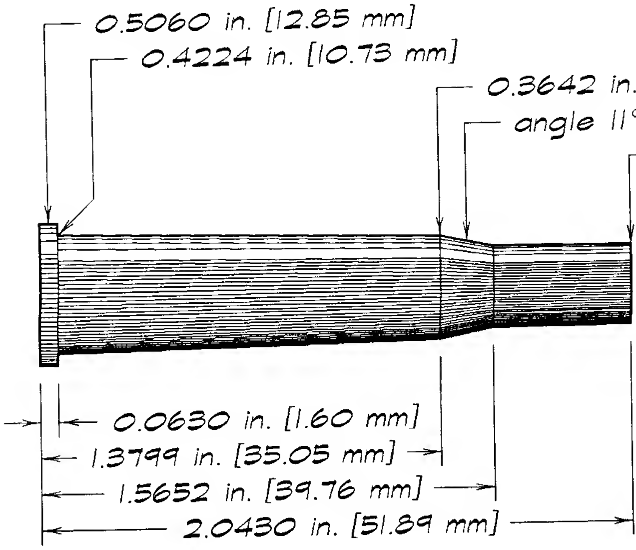
Form from .30-30 Winchester brass, in RCBS form dies. Trim to length. Ream inside neck, with RCBS neck-ream set. Deburr.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.25-35 Winchester

(SAAMI maximums)

solid:
472 gr brass
55 gr water



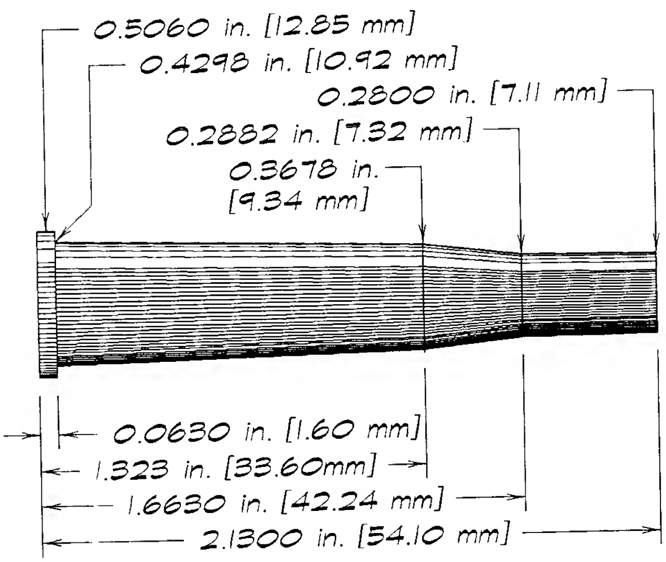
.258 bullet displaces
13.22 grains per inch.

Use recently manufactured .25-35 Winchester factory brass, or form from .30-30 Winchester brass, in RCBS form dies.

.25-36 Marlin

(Winchester drawing, 1911)

solid:
450 gr brass
53 gr water



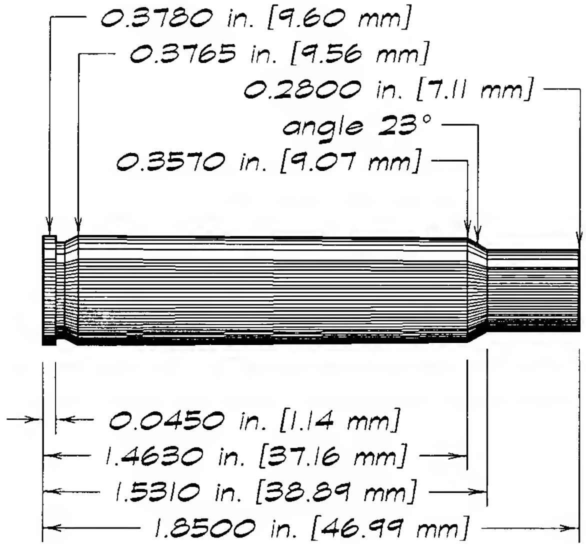
.257 bullet displaces
13.12 grains per inch.

Form .30-30 Winchester brass in RCBS .25-36 Marlin form dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.25x47mm (6.35x47mm, .25-.222 Magnum) (David J LeGate)

solid:
390 gr brass
46 gr water

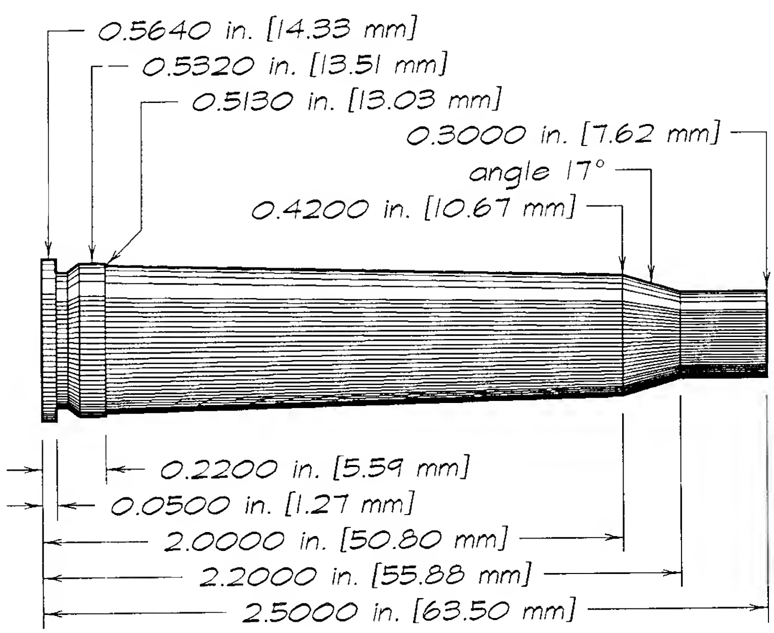


.257 bullet displaces 13.12 grains per inch.

Fire-form .222 Remington Magnum brass with inert filler.

.250 Cogswell & Harrison (Kynoch drawing, 1921)

solid:
862 gr brass
101 gr water



.258 bullet displaces 13.22 grains per inch.

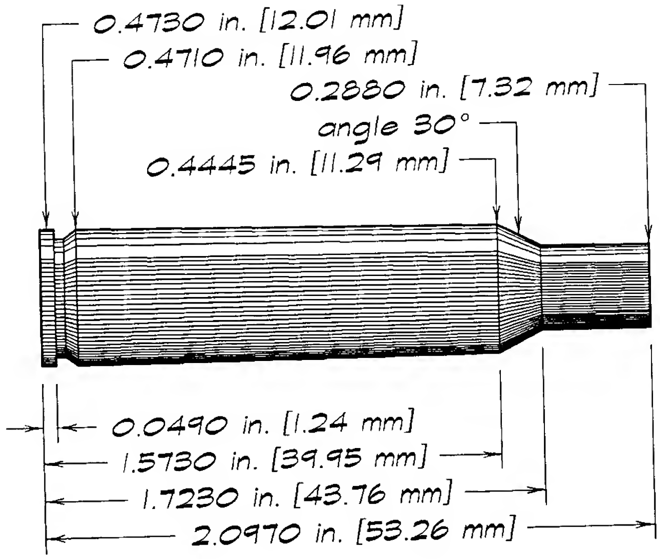
Fire-form 7mm Remington brass with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.250 Donaldson

(unidentified drawing)

solid:
644 gr brass
76 gr water



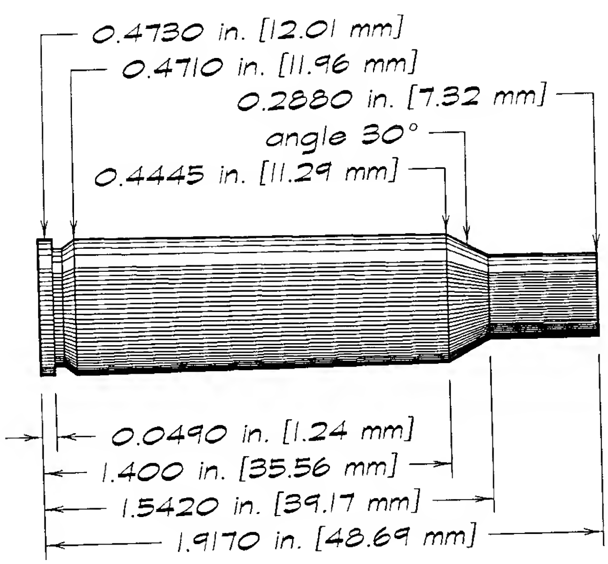
.257 bullet displaces
13.12 grains per inch.

Anneal neck and shoulder of .257 Roberts brass and form in RCBS form and trim dies. Trim and deburr.

.250 Donaldson Ace

(unidentified drawing)

solid:
535 gr brass
63 gr water



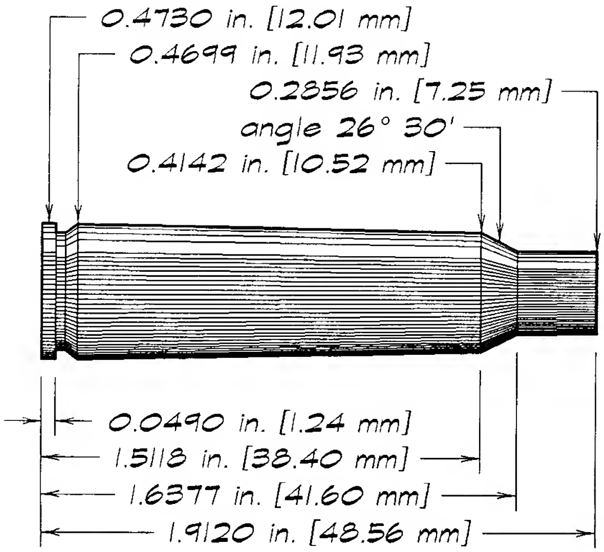
.257 bullet displaces
13.12 grains per inch.

Form from .250 Savage brass, in RCBS form-and-trim die.

Anneal only by method shown in text. *Text explains use of "solid" and displacement figures.*

.250 Savage (.250-3000 Savage)

(SAAMI maximums)



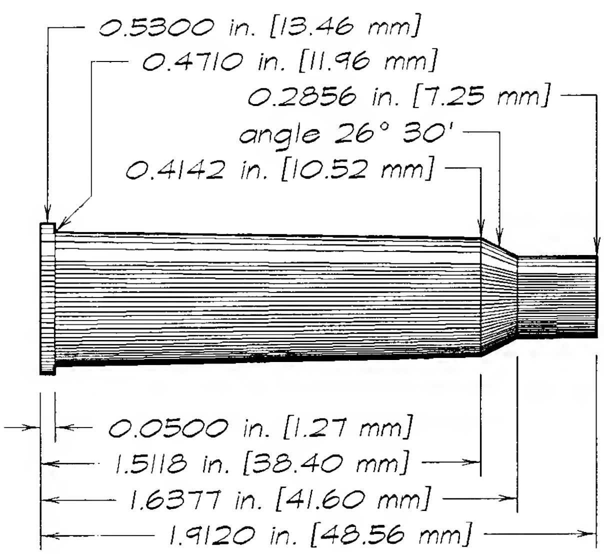
solid:
582 gr brass
68 gr water

.258 bullet displaces
13.22 grains per inch.

Use recently manufactured factory .250 Savage cases. Or form from .308 Winchester or .30-06 Springfield brass, in RCBS form, trim, and neck-ream dies.

.250 Savage Rimmed

(designer's specs)



solid:
580 gr brass
68 gr water

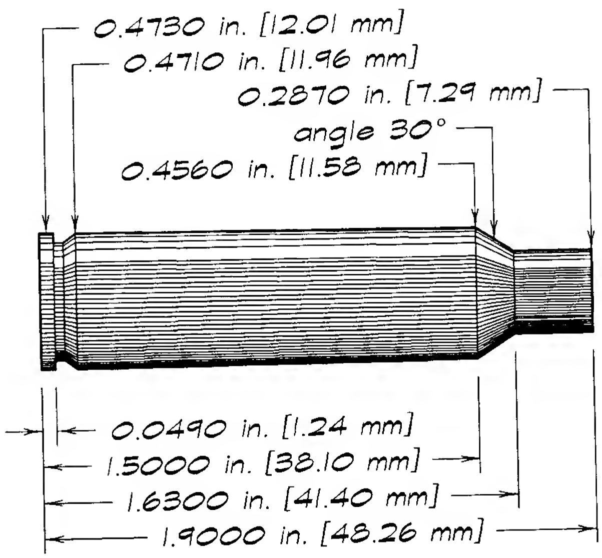
.258 bullet displaces
13.22 grains per inch.

Form from .307 Winchester brass, in RCBS form-and-trim die. Or anneal shoulder and upper body of .400-.350 NE brass and form in RCBS form-and-trim die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.250-3000 Improved (30°) (David J LeGate)

solid:
608 gr brass
71 gr water

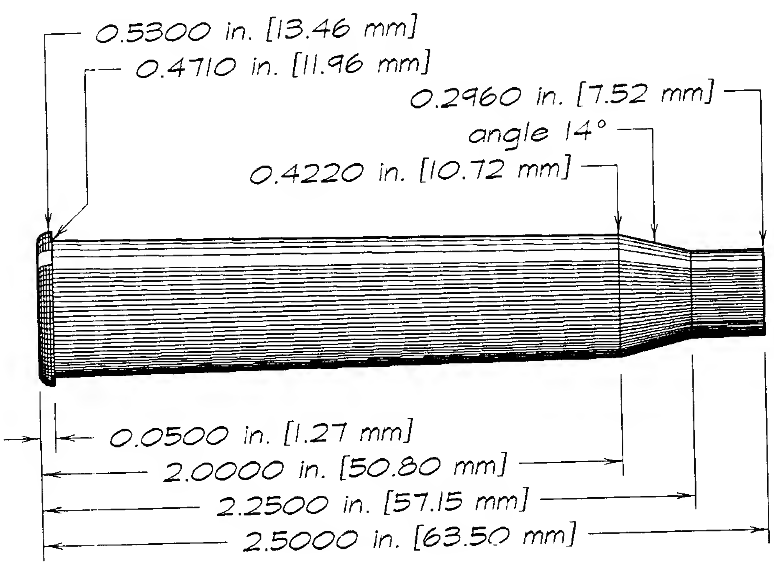


.257 bullet displaces 13.12 grains per inch.

Fire .250 Savage (.250-3000) ammunition in .250-3000 Improved chamber. Or fire-form .250 Savage or .243 Winchester brass with inert filler. Or form from .308 Winchester brass, in RCBS form, trim, and neck-ream dies. Fire-form with inert filler.

.252 McNaughton (Kynoch drawing, 1922)

solid:
778 gr brass
91 gr water

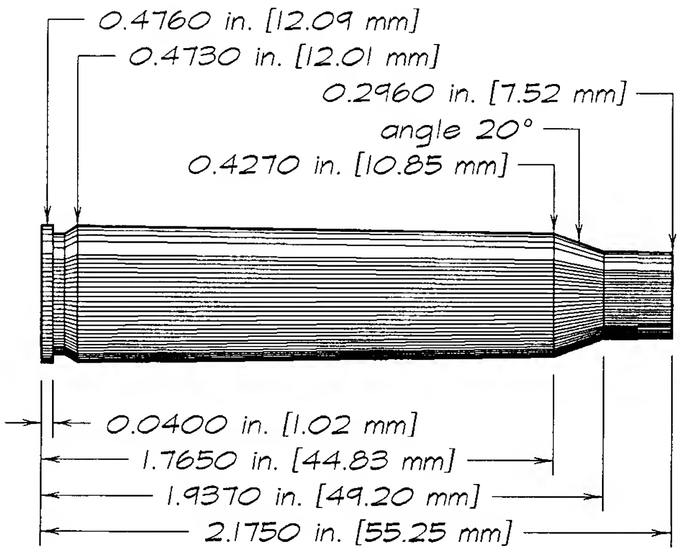


.258 bullet displaces 13.22 grains per inch

Form from 9.3x74mm Rimmed brass, in RCBS form and trim dies. Fire-form with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.256 Magnum (Gibbs) (Birmingham Proof House)

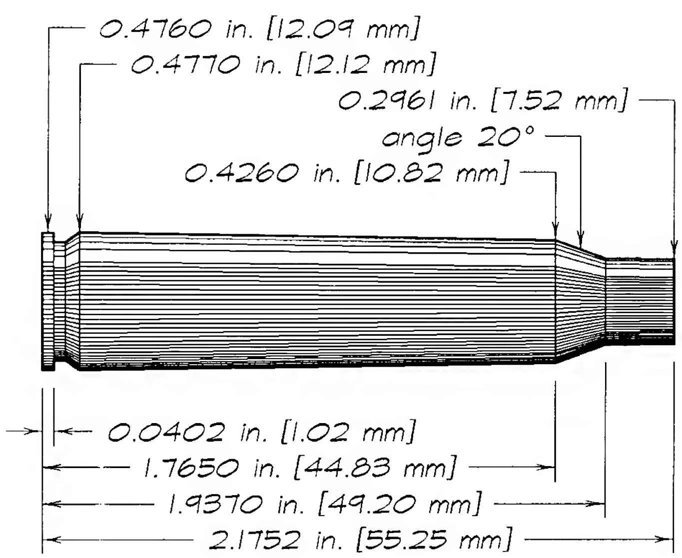


solid:
697 gr brass
82 gr water

.265 bullet displaces
13.95 grains per inch.

Use factory .256 Magnum Gibbs brass. Or form from .25-06 or .270 Winchester brass in RCBS form and trim dies. Ream inside neck, in RCBS neck-ream die. Deburr. Resize full-length in .256 Magnum Gibbs sizer die.

.256 Magnum Gibbs (CIP maximums)



solid:
699 gr brass
82 gr water

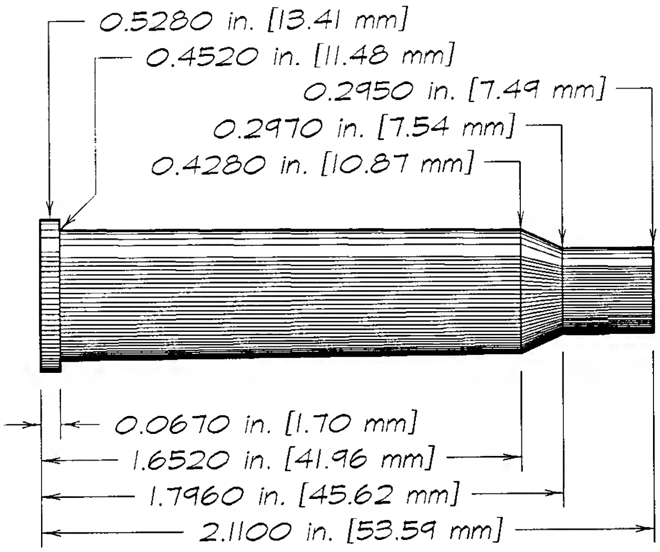
.265 bullet displaces
13.95 grains per inch.

Use factory .256 Magnum Gibbs brass. Or form from .25-06 Remington or .270 Winchester brass in RCBS form and trim dies. Ream inside neck, in RCBS neck-ream die. Deburr. Resize full-length in .256 Magnum Gibbs sizer die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.256 Mannlicher (Rimmed)

(Birmingham Proof House)



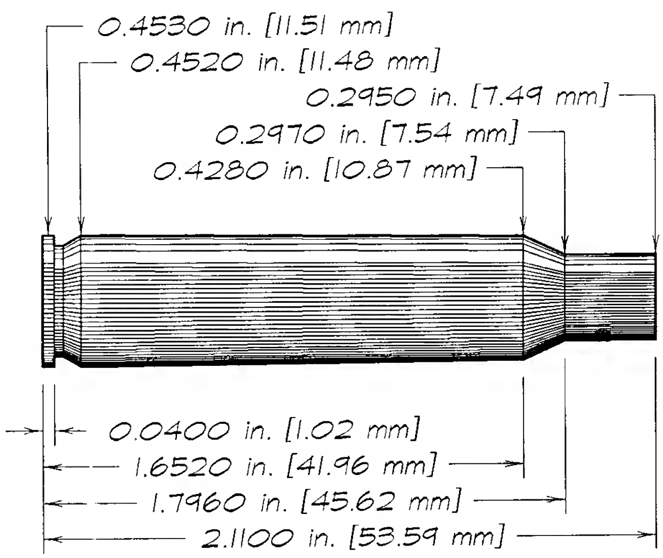
solid:
617 gr brass
72 gr water

.263 bullet displaces
13.74 grains per inch.

Form from .30-40 Krag or .303 British brass, in RCBS form and trim dies.

.256 Mannlicher Schoenauer

(Birmingham Proof House)



solid:
615 gr brass
72 gr water

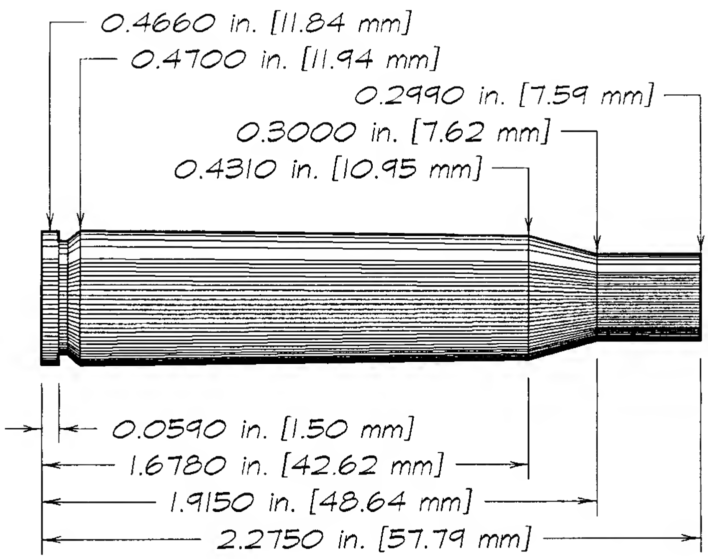
.263 bullet displaces
13.74 grains per inch.

Use factory .256 MS (6.5x54mm MS) brass. There's no satisfactory substitute. (Possible but hardly satisfactory: forming from .30-06 Springfield brass, using a special RCBS set of form and trim dies in an arbor press, recutting extractor groove, and redrilling primer vent)

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.256 Mauser (Birmingham Proof House)

solid:
691 gr brass
81 gr water

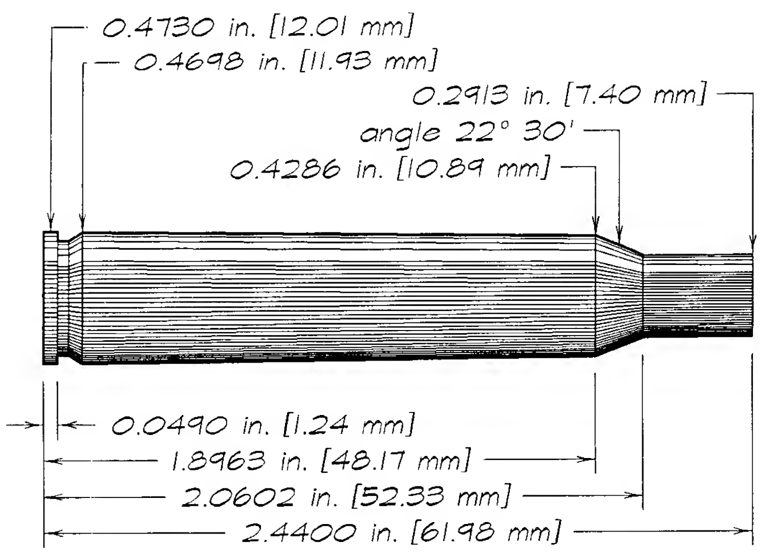


.263 bullet displaces
13.74 grains per inch.

Use factory .256 Mauser (6.5x58mm) brass. Or form from .270 Winchester or .30-06 Springfield brass, in RCBS form-and-trim die.

.256 Newton (Western Ctg Co dwg)

solid:
752 gr brass
88 gr water



.264 bullet displaces
13.84 grains per inch.

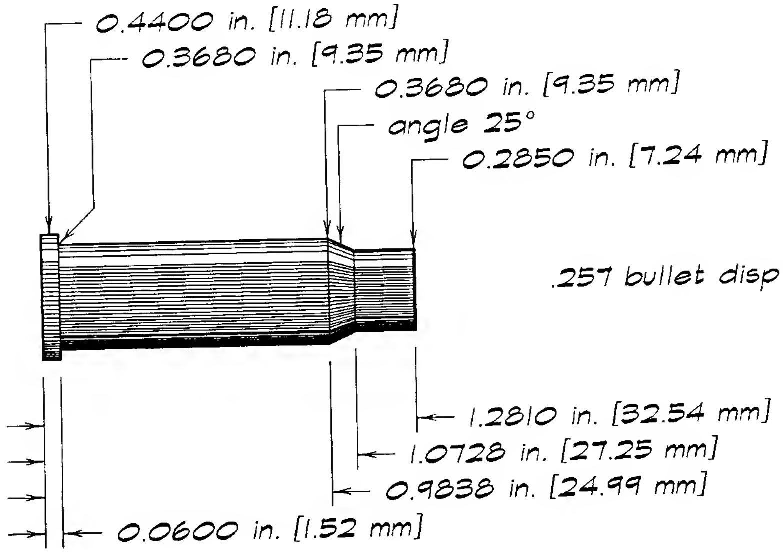
Resize .25-06 Remington brass full-length in .256 Newton sizer die. Trim to 2.44 inches and deburr. Or form from .270 Winchester, .280 Remington, or .30-06 Springfield brass, in RCBS form and trim dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.256 Winchester Magnum

(SAAMI maximums)

solid:
266 gr brass
31 gr water



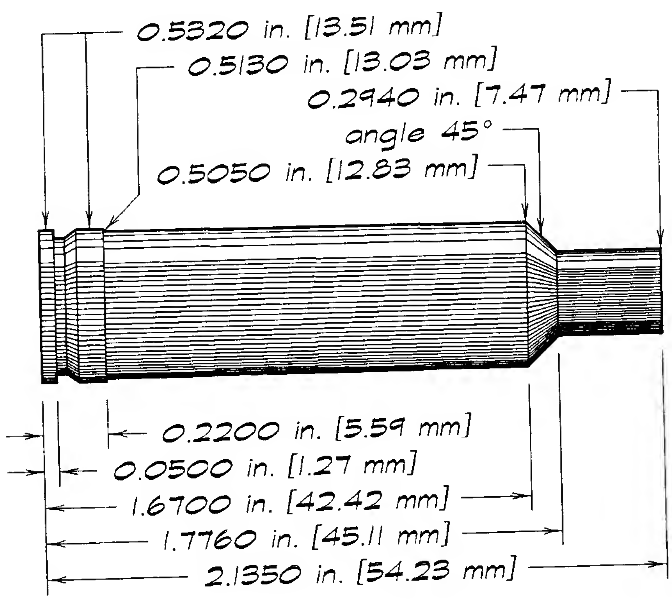
.257 bullet displaces 13.12 grains per inch.

Use recently manufactured .256 Magnum brass. Or anneal mouth of .357 Magnum brass and form in RCBS .256 Winchester Magnum form and trim dies.

.257 Davis Short Magnum

(designer's specs)

solid:
830 gr brass
97 gr water

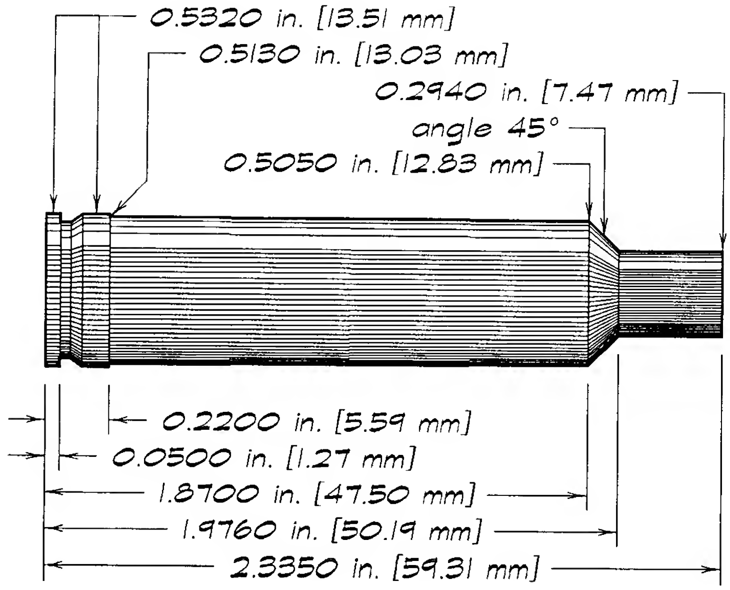


.257 bullet displaces 13.12 grains per inch.

Anneal neck, shoulder, and upper body of 6.5mm Remington Magnum brass. Resize full-length in .257 DSM sizer die. Fire-form with inert filler. Trim. Deburr.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.257 Davis Short Magnum Number 2 (designer's specs)

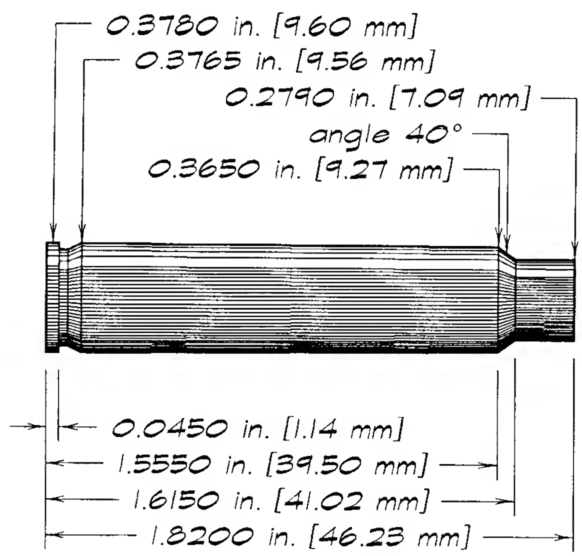


solid:
920 gr brass
108 gr water

.257 bullet displaces
13.12 grains per inch.

Anneal neck, shoulder, and upper body of 6.5mm Remington Magnum brass. Resize full-length in .257 DSM No. 2 sizer die. Fire-form with inert filler. Trim. Deburr.

.257 Kimber (David J LeGate)



solid:
398 gr brass
47 gr water

.257 bullet displaces
13.12 grains per inch.

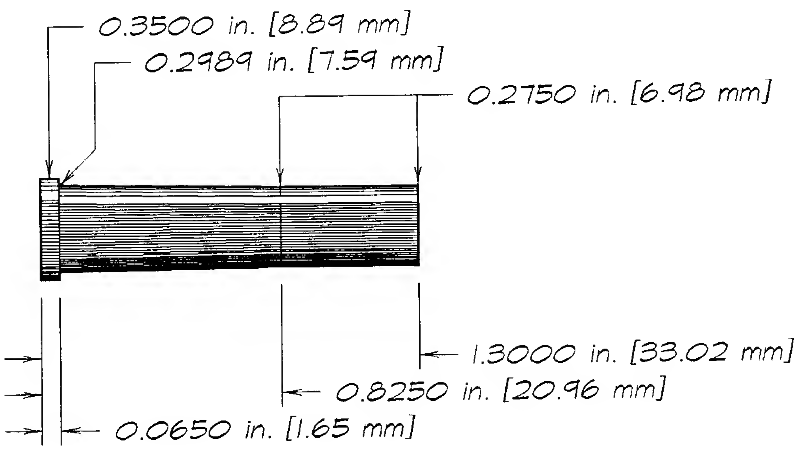
Fire-form .222 Remington Magnum brass with inert filler.

Anneal only by method shown in text. *Text explains use of "solid" and displacement figures.*

.257 Magnum Revolver

(David J LeGate)

solid:
166 gr brass
19 gr water



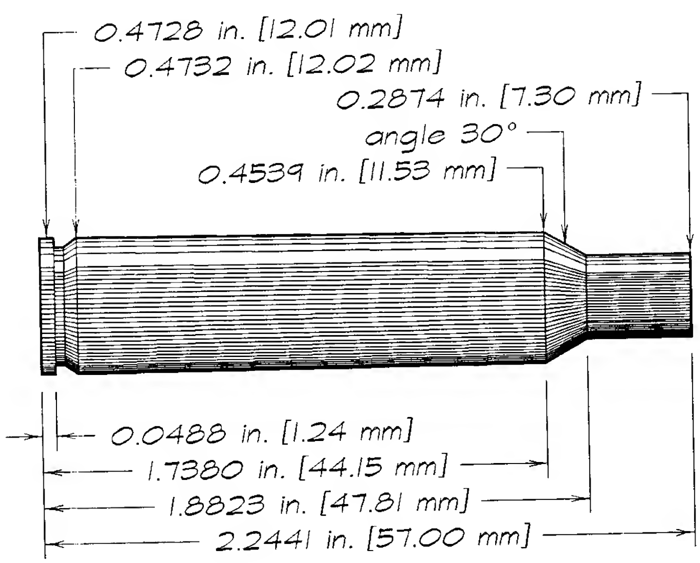
.257 bullet displaces
13.12 grains per inch.

Anneal neck and shoulder of .22 Hornet brass (preferably RWS) and fire-form with inert filler.

.257 Roberts Improved, 30°

(Triebel maximums)

solid:
709 gr brass
83 gr water

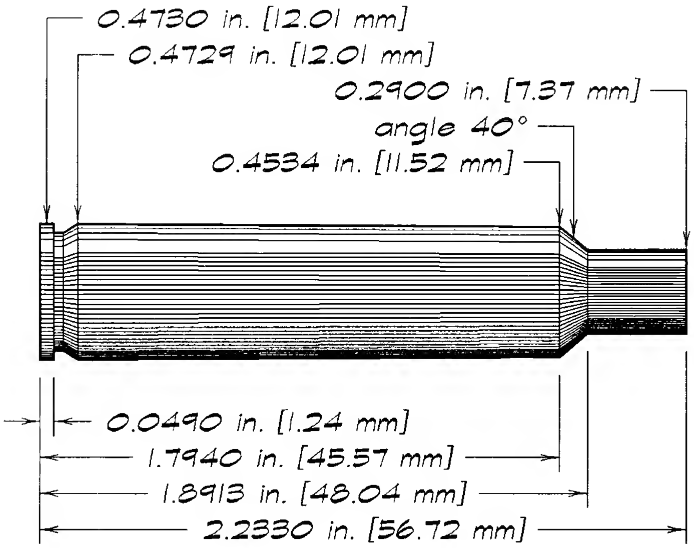


.257 bullet displaces
13.12 grains per inch.

Fire .257 Roberts ammunition in .257 Roberts Improved chamber. Or fire-form .257 Roberts brass with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.257 Roberts Improved (Ackley version) (RCBS drawing)

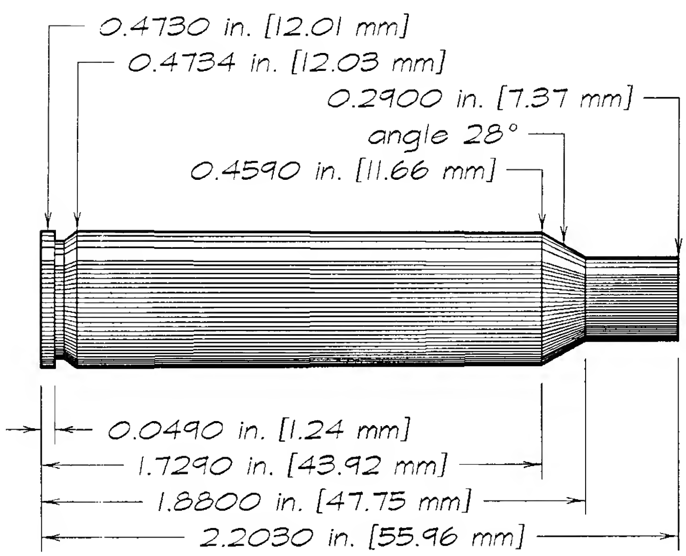


solid:
715 gr brass
84 gr water

.258 bullet displaces
13.22 grains per inch.

Fire-form .257 Roberts case. Or form from 7x57mm Mauser or .30-06, in RCBS form die. Fire-form with inert filler. (Ream neck of case formed from .30-06.)

.257 Roberts Improved, RCBS (David J Le Gate)



solid:
708 gr brass
83 gr water

.257 bullet displaces
13.22 grains per inch.

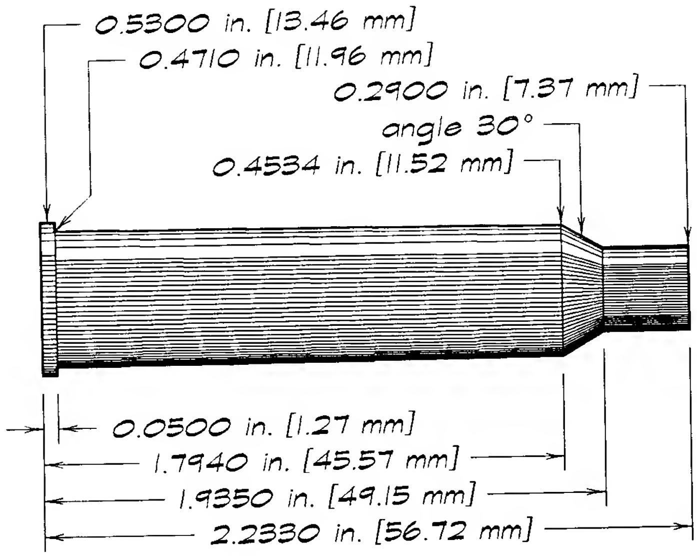
Fire .257 Roberts ammunition, or fire-form .257 Roberts brass with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.257 Roberts Improved, Rimmed

(designer's specs)

solid:
757 gr brass
89 gr water



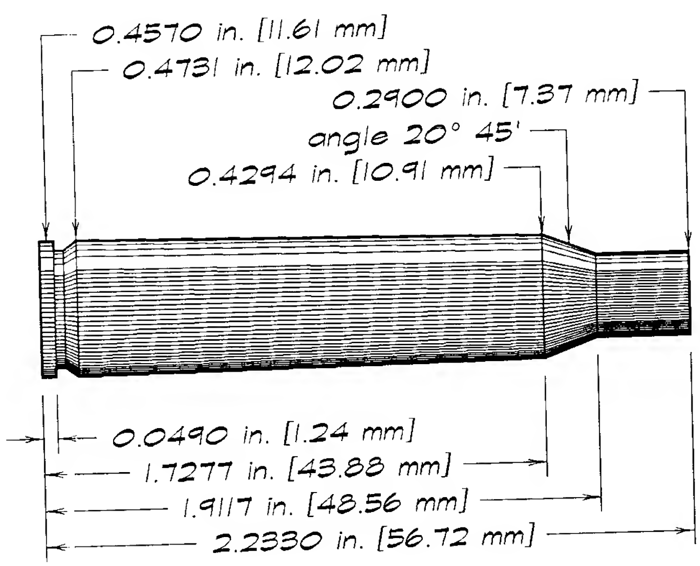
.257 bullet displaces
13.12 grains per inch.

Anneal neck, shoulder, and upper body of .400-.350 Nitro Express or .400 NE Basic brass. Trim to 2¼ inches. Form and trim in RCBS form and trim dies. Ream inside neck, in RCBS neck-ream die. Fire-form with inert filler.

.257 Roberts

(SAAMI maximums)

solid:
691 gr brass
81 gr water



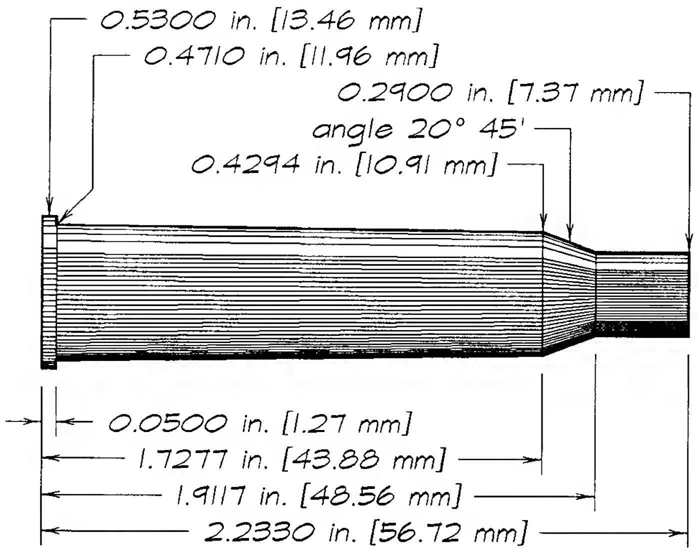
.258 bullet displaces
13.22 grains per inch.

Use recently factory-made .257 Roberts brass, or do what Ned Roberts did in its beginning: resize 7x57mm Mauser brass full-length in .257 Roberts sizer die. Or form from .30-06 Springfield brass, in RCBS form, trim, and neck-ream dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.257 Roberts Rimmed

(designer's specs)



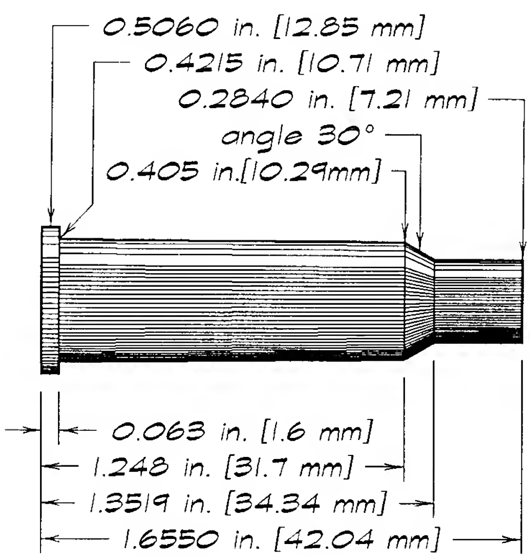
solid:
690 gr brass
81 gr water

.258 bullet displaces
13.22 grains per inch.

Anneal shoulder and upper body of .400-.350 NE brass. Form and trim in RCBS form and trim dies. Ream inside neck. Deburr mouth.

.257 Sabrecat

(designer's specs)



solid:
430 gr brass
50 gr water

.257 bullet displaces
13.12 grains per inch.

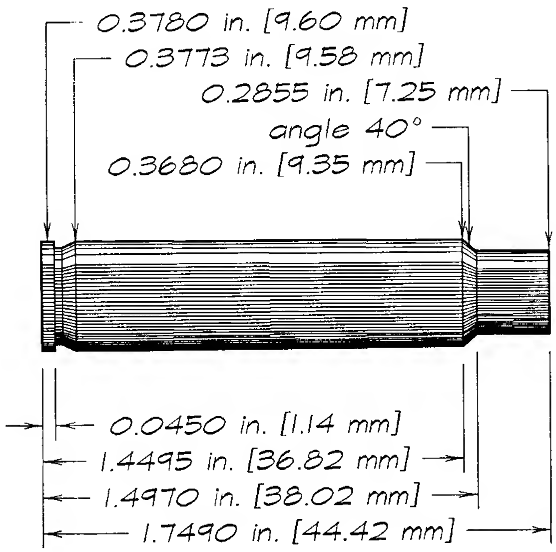
Form from .30-30 Winchester brass, in RCBS form and trim dies. Adjust sizer die to headspace cartridge on shoulder instead of rim.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.257 Ugalde, .257 T/CU

(Thompson/Center dwg)

solid:
383 gr brass
45 gr water



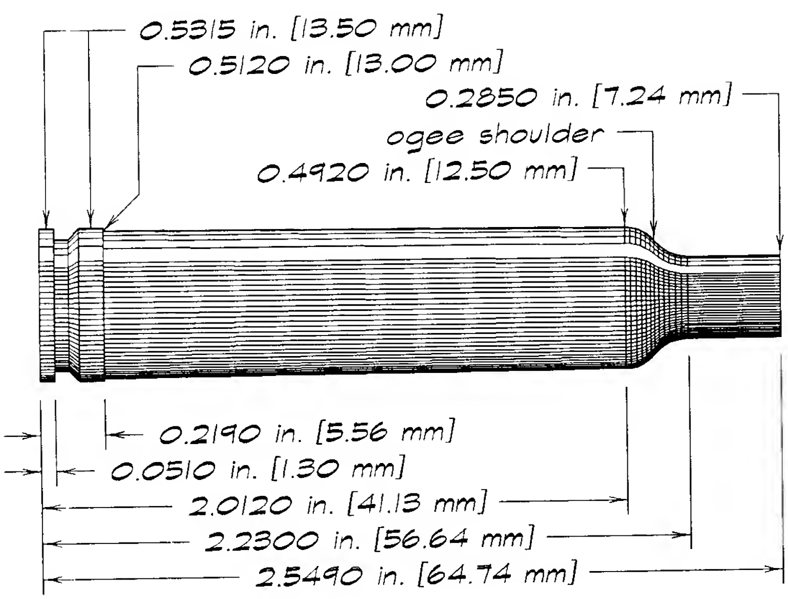
.258 bullet displaces
13.22 grains per inch.

Fire-form .223 Remington brass with inert filler.

.257 Weatherby Magnum

(SAAMI maximums, 1986)

solid:
991 gr brass
116 gr water



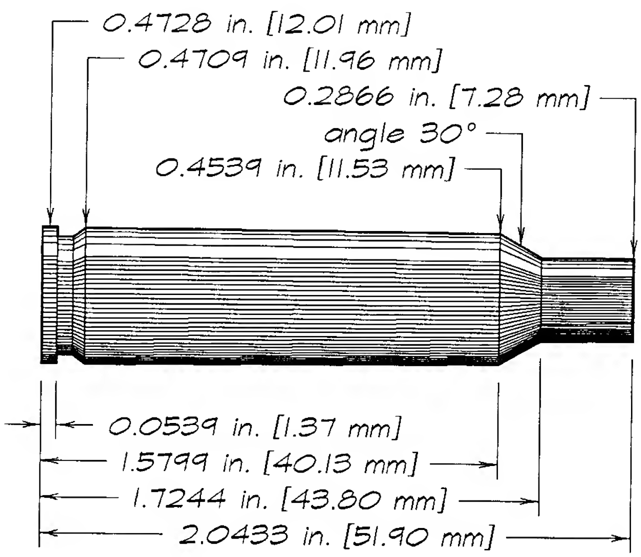
.257 bullet displaces
13.12 grains per inch.

Form from .300 H&H Magnum brass, in RCBS form dies. Trim to length, deburr, and fire-form with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.257-.243 Improved, 30°

(Triebel maximums)



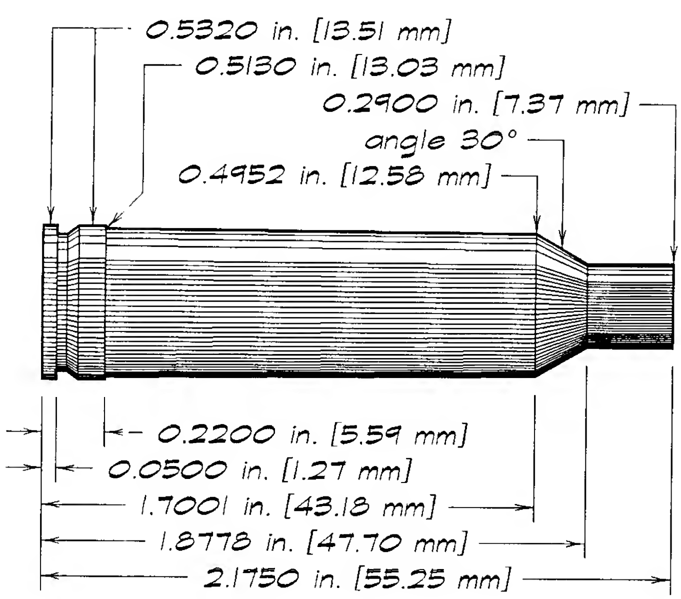
solid:
643 gr brass
75 gr water

.257 bullet displaces
13.12 grains per inch.

Fire-form .243 Winchester brass with inert filler.

.257-.350 Remington Magnum

(designer's specs)



solid:
846 gr brass
99 gr water

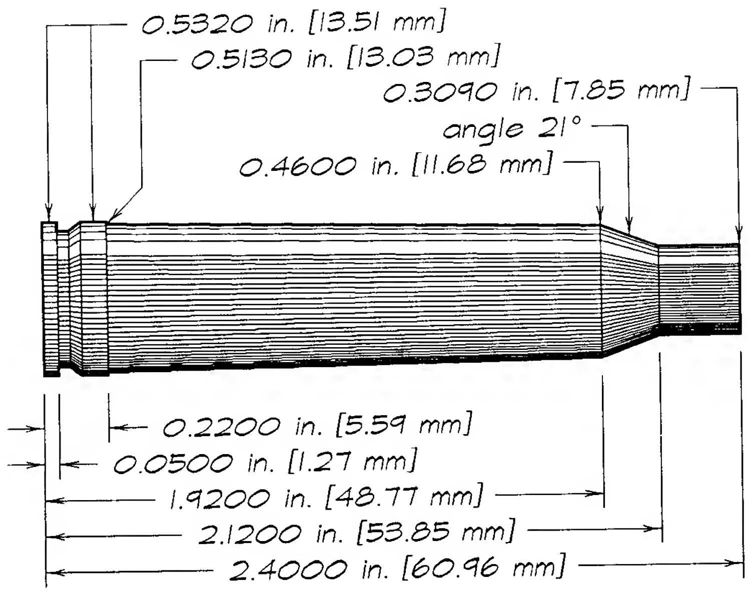
.258 bullet displaces
13.22 grains per inch.

Anneal neck and shoulder of .350 Remington Magnum or 6.5mm Remington brass.
Form .350 brass in RCBS form and trim dies. Resize 6.5mm brass full-length.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.26 BSA

(Kynoch drawing, 1920)



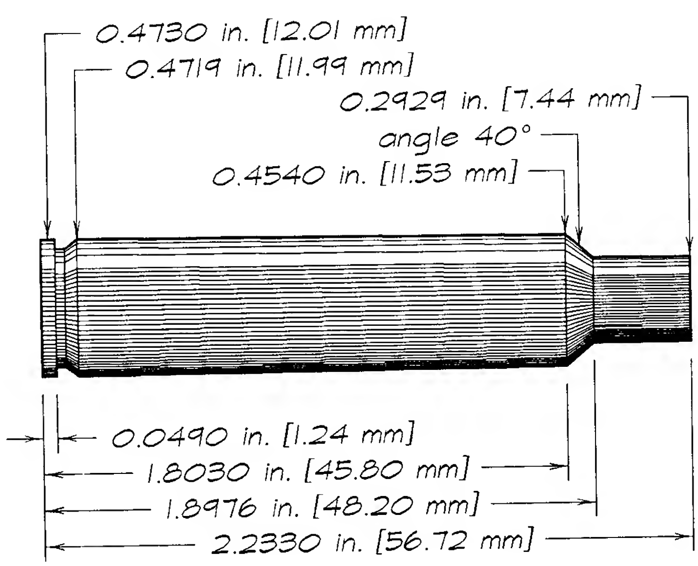
solid:
910 gr brass
107 gr water

.268 bullet displaces
14.27 grains per inch.

Resize .264 Winchester Magnum brass full-length in .26 BSA sizer die. Trim to 2.4 inches, deburr mouth, and fire-form with inert filler.

.260 AAR

(F K Elliott drawing)



solid:
719 gr brass
84 gr water

.264 bullet displaces
13.84 grains per inch.

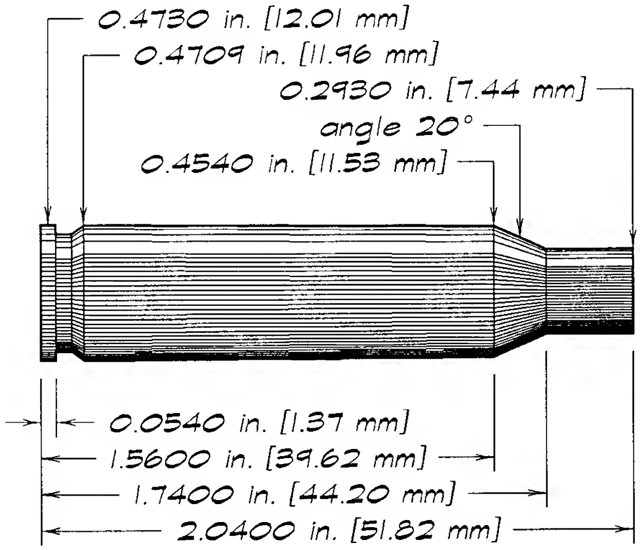
Resize .257 Roberts brass full-length in .260 AAR sizer die, then fire-form with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.263 Express

(David J LeGate)

solid:
645 gr brass
76 gr water



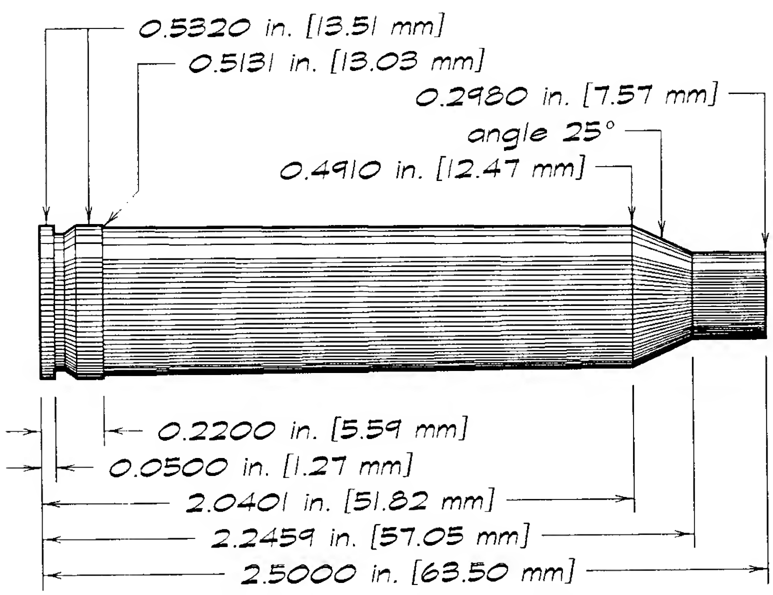
.264 bullet displaces
13.84 grains per inch.

Fire-form .243 Winchester brass with inert filler. Or resize .308 Winchester brass full-length in .263 Express sizer die, ream inside necks, and deburr mouths.

.264 Winchester Magnum

(SAAMI maximums)

solid:
996 gr brass
117 gr water



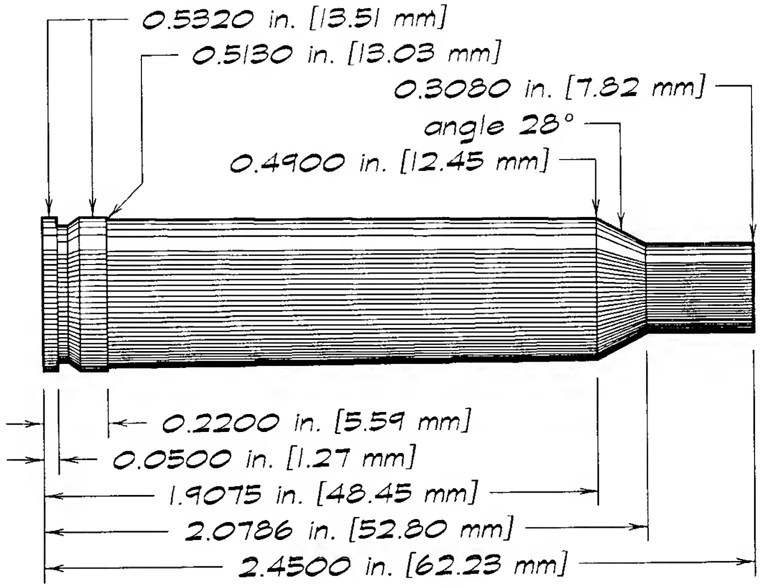
.264 bullet displaces
13.84 grains per inch.

Use factory-made .264 Winchester Magnum cases. Or resize .300 Winchester cases full-length in .264 Winchester Magnum sizer die. Or form from .300 H&H Magnum brass, in RCBS form die. Ream inside neck (.300), in RCBS neck-ream die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.270 Ackley Magnum

(Speer manual number 4)



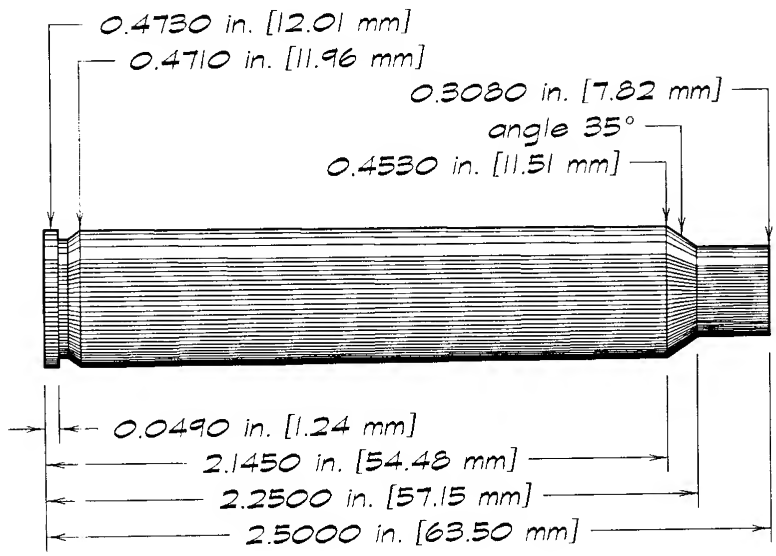
solid:
949 gr brass
111 gr water

.277 bullet displaces
15.24 grains per inch.

Anneal neck and shoulder of .264 or .300 Winchester Magnum or 7mm Remington Magnum brass. Resize full-length in .25 Ackley Magnum sizer die. Fire-form with inert filler. Trim. Deburr.

.270 Gibbs

(David J LeGate)



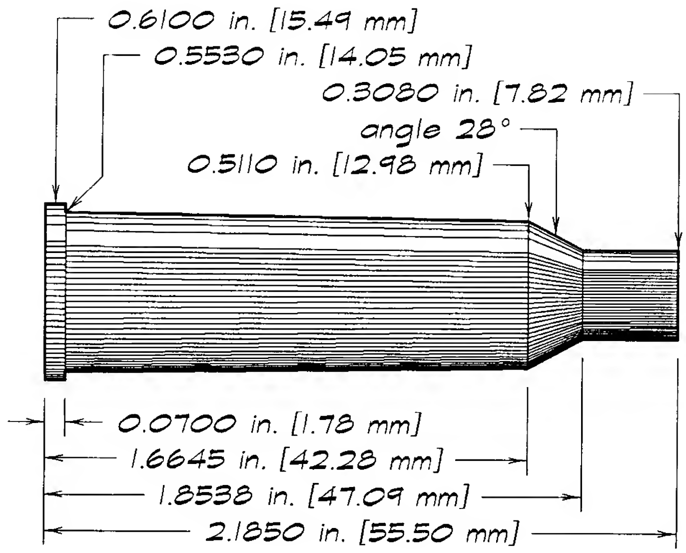
solid:
835 gr brass
98 gr water

.277 bullet displaces
15.24 grains per inch.

Anneal neck, shoulder, and upper body of .280 Remington, .30-06 Springfield, or .35 Whelen brass. Form in .270 Gibbs form die. Fire-form with inert filler. Ream neck, if necessary, in RCBS neck-ream die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.270 Pfeifer Rimmed (F K Elliott drawing)

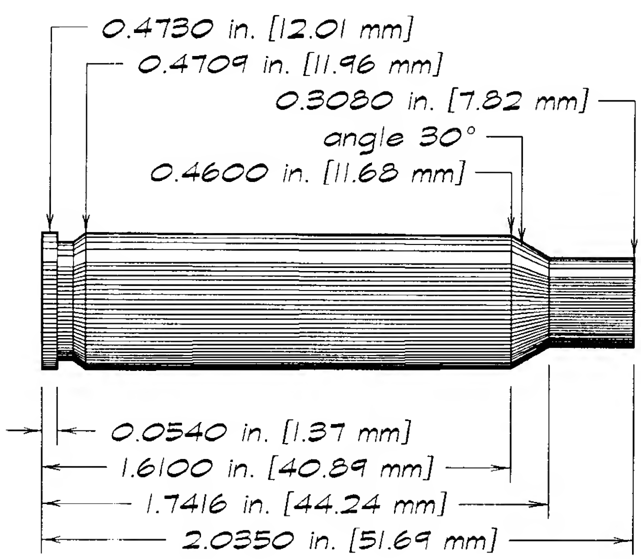


solid:
937 gr brass
110 gr water

.277 bullet displaces 15.24 grains per inch.

Anneal neck and shoulder of .348 Winchester brass. Form and trim in RCBS form and trim dies. Deburr. Fire-form with inert filler.

.270 Redding (David J LeGate)



solid:
661 gr brass
78 gr water

.277 bullet displaces 15.24 grains per inch.

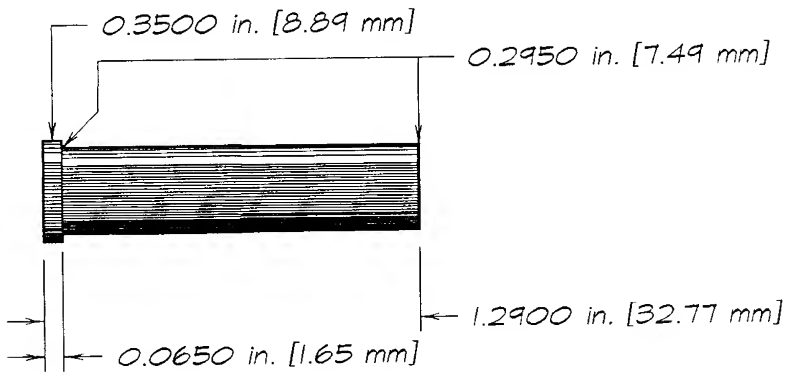
Fire-form .243 Winchester brass with inert filler. Or resize .308 Winchester brass full-length in .270 Redding die, then fire-form with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.270 Ren

(unidentified drawing)

solid:
190 gr brass
22 gr water



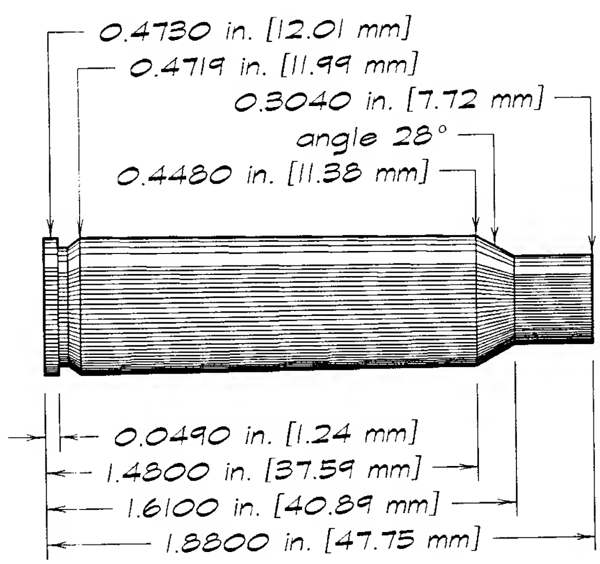
.277 bullet displaces
15.24 grains per inch.

Fire-form .22 Hornet brass with inert filler.

.270 Titus Savage (.270-.300 Savage)

(Speer manual number 4)

solid:
602 gr brass
71 gr water



.277 bullet displaces
15.24 grains per inch.

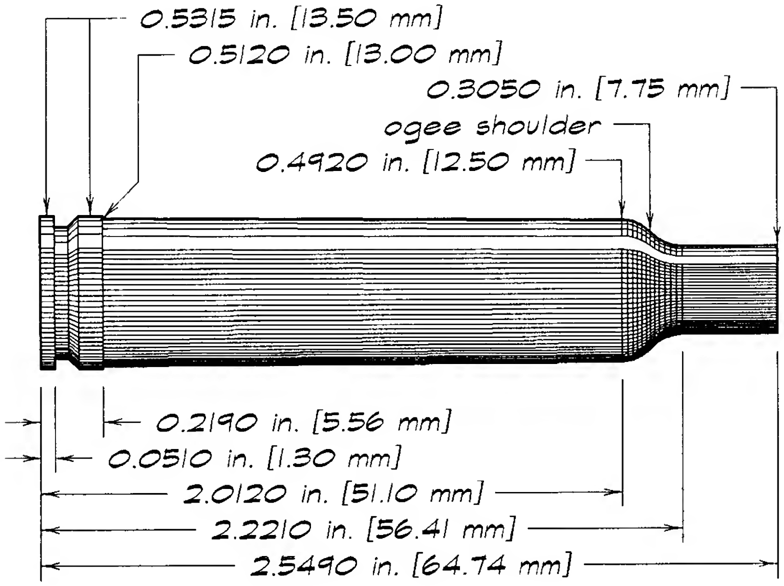
Resize .300 Savage brass full-length in .270 Titus Savage sizer die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.270 Weatherby Magnum

(SAAMI maximums, 1986)

solid:
991 gr brass
116 gr water



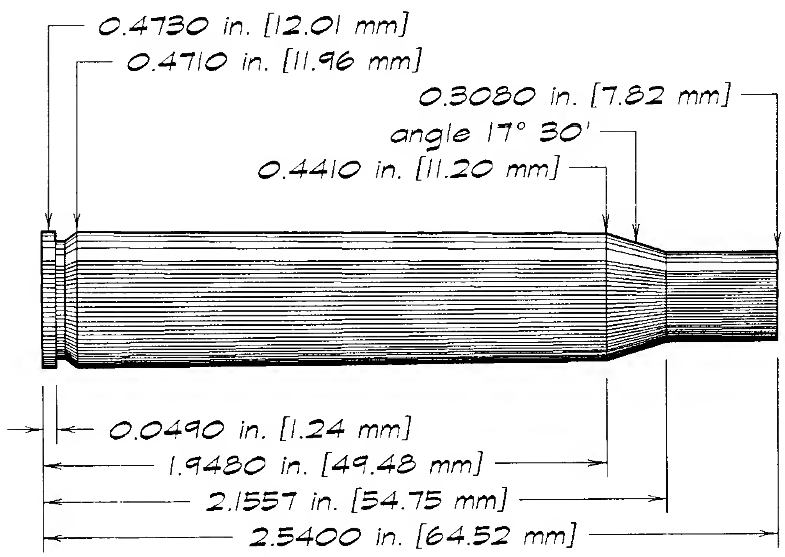
.277 bullet displaces
15.24 grains per inch.

Form from .300 H&H Magnum brass, in RCBS form dies.

.270 Winchester

(SAAMI maximums)

solid:
799 gr brass
94 gr water



.277 bullet displaces
15.24 grains per inch.

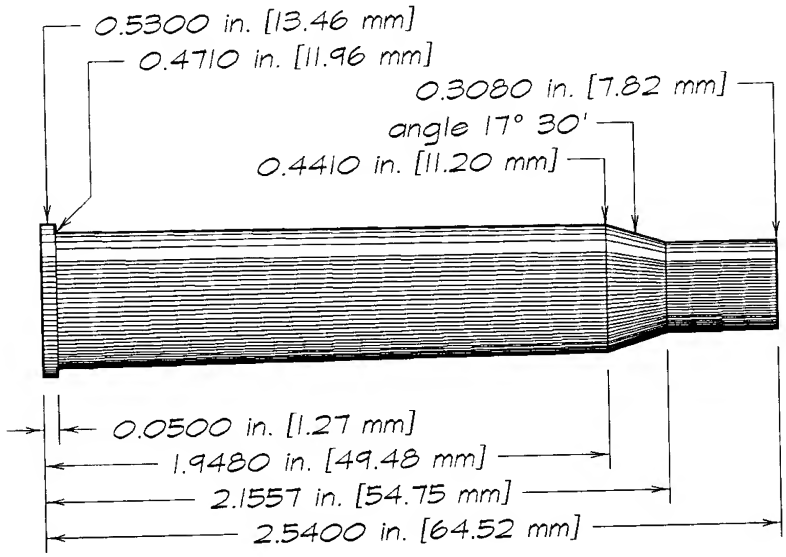
Use readily available, recently manufactured .270 Winchester cases. Or resize .280 Remington brass full-length in .270 Winchester sizer die. Or fire-form 25-06 brass with inert filler. Or form from .30-06 brass, in RCBS form-and-trim die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.270 Winchester Rimmed

(designer's specs)

solid:
807 gr brass
95 gr water

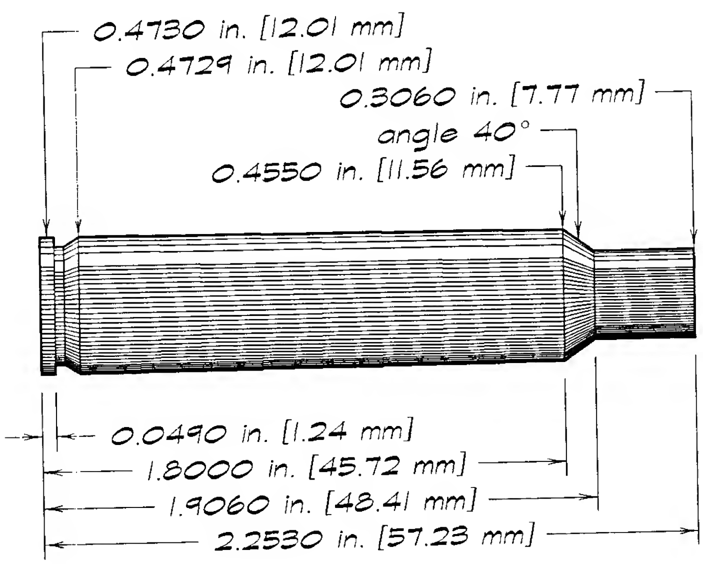


Trim .400-.350 NE brass to 2.55 inches and resize full-length in .270 Winchester sizer die. Fire-form with inert filler, trim to 2.54 inches, and deburr.

.270-.257 Roberts Improved (Ackley)

(Speer manual number 4)

solid:
727 gr brass
85 gr water



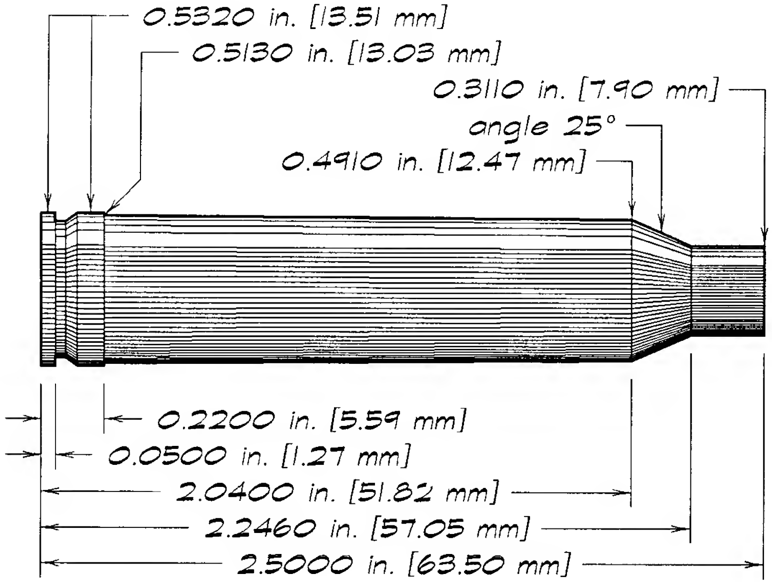
.284 bullet displaces 16.02 grains per inch.

Fire-form .257 Roberts case. Or form from 7x57mm Mauser or .30-06, in RCBS form die. Fire-form with inert filler to sharpen shoulder.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.270-.264 Magnum

(unidentified drawing)



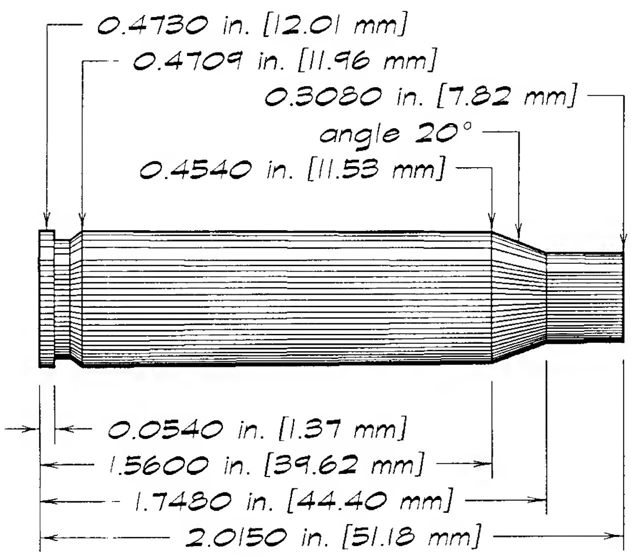
solid:
1,000 gr brass
117 gr water

.264 bullet displaces 13.84 grains per inch.

Resize .264 Winchester Magnum brass full-length in body of .270-.264 Magnum sizer die. Fire-form with inert filler.

.270-.308 Winchester

(David J LeGate)



solid:
647 gr brass
76 gr water

.277 bullet displaces 15.24 grains per inch.

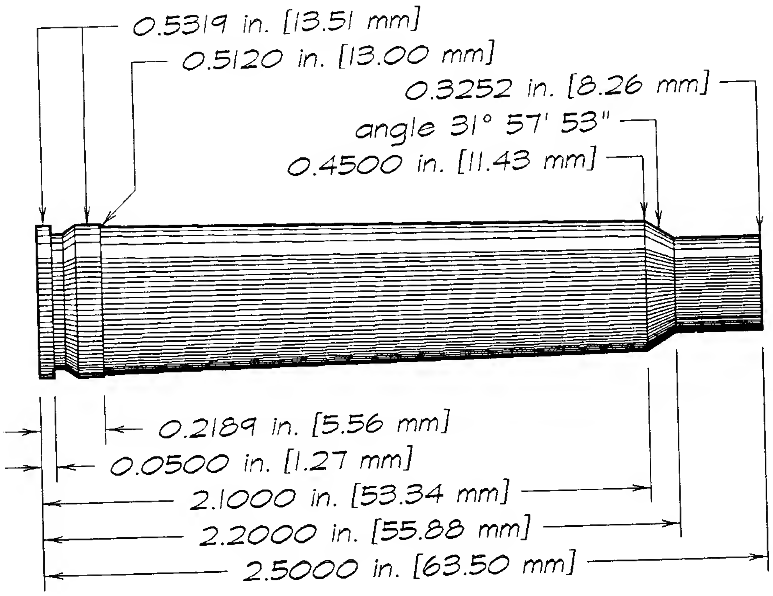
Fire-form .243 Winchester brass with inert filler. Or resize .308 Winchester brass full-length in .270-.308 sizer die, then fire-form with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.275 Belted Nitro Express

(CIP maximums)

solid:
944 gr brass
111 gr water



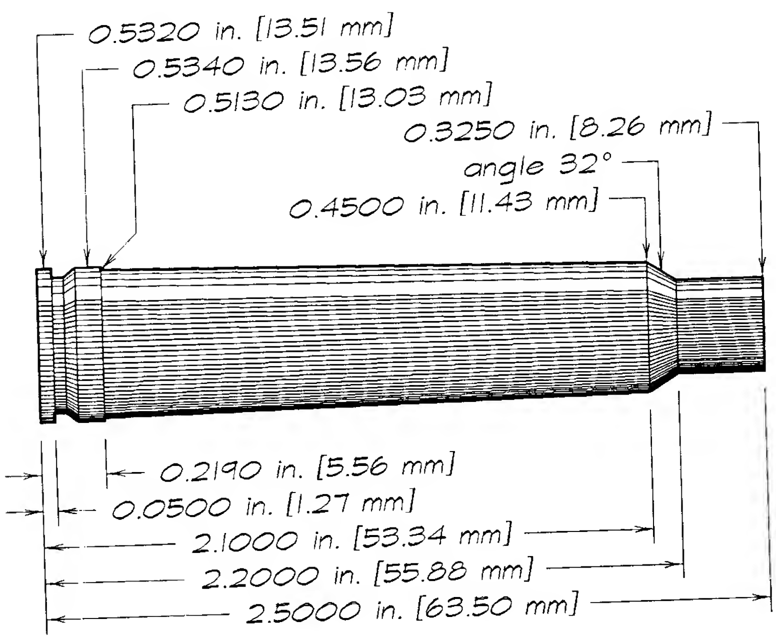
.287 bullet displaces 16.36 grains per inch.

Use factory .275 BNE brass. Or form from 7mm Remington Magnum brass, in RCBS .275 BNE form and trim dies.

.275 Belted Rimless Magnum Nitro Express

(Birmingham Proof House)

solid:
946 gr brass
111 gr water

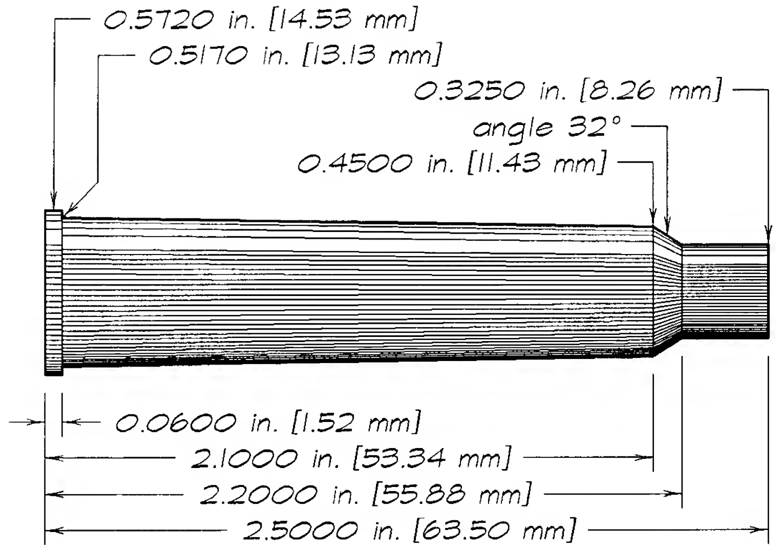


.287 bullet displaces 16.36 grains per inch.

Use factory .275 H&H Magnum brass. Or form from 7mm Remington Magnum brass, in RCBS form and trim dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.275 Holland & Holland Flanged Magnum (ICI Metals Ltd dwg)

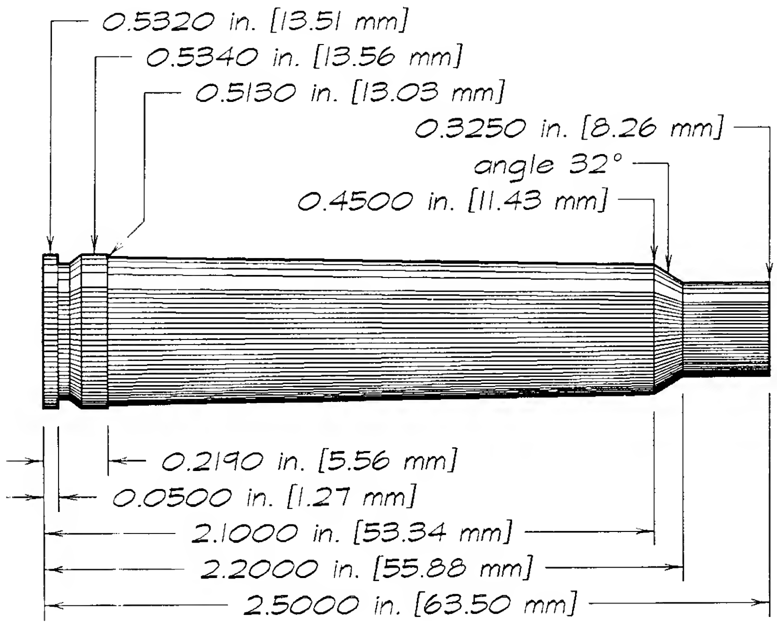


solid:
934 gr brass
110 gr water

.287 bullet displaces
16.36 grains per inch.

Form from .375 Flanged NE brass or .375 Flanged Basic brass, in RCBS form and trim dies.

.275 Holland & Holland Magnum "Rimless" (ICI Metals Ltd dwg)



solid:
946 gr brass
111 gr water

.287 bullet displaces
16.36 grains per inch.

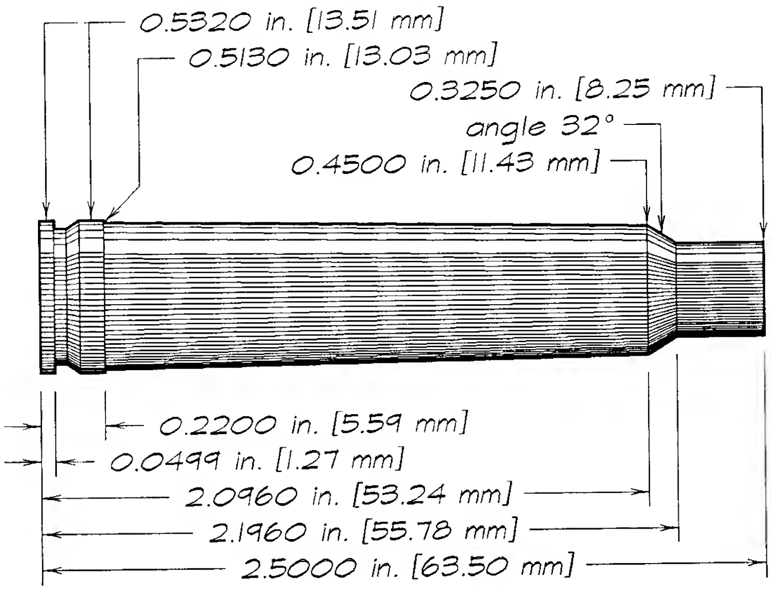
Form from 7mm Remington Magnum brass, in RCBS form and trim dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.275 H&H Magnum

(Western Ctg Co dwg)

solid:
944 gr brass
111 gr water



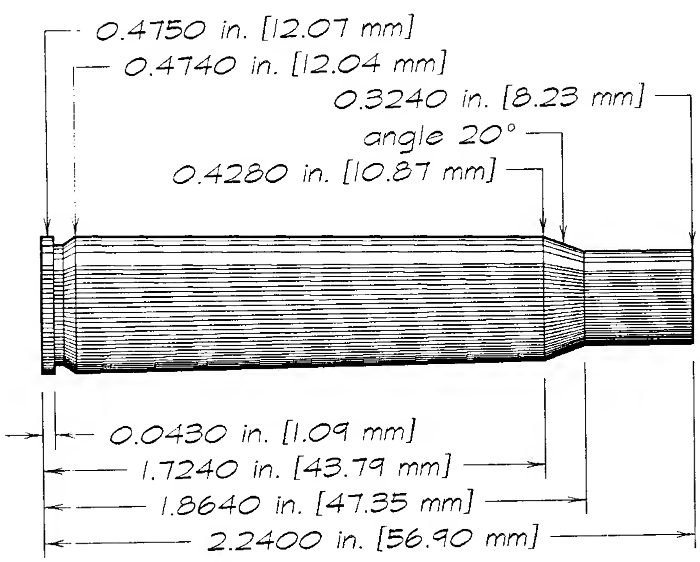
.284 bullet displaces 16.02 grains per inch.

Form from 7mm Remington Magnum brass, in RCBS form and trim dies.

.275 High-Velocity Rigby

(Birmingham Proof House)

solid:
702 gr brass
82 gr water



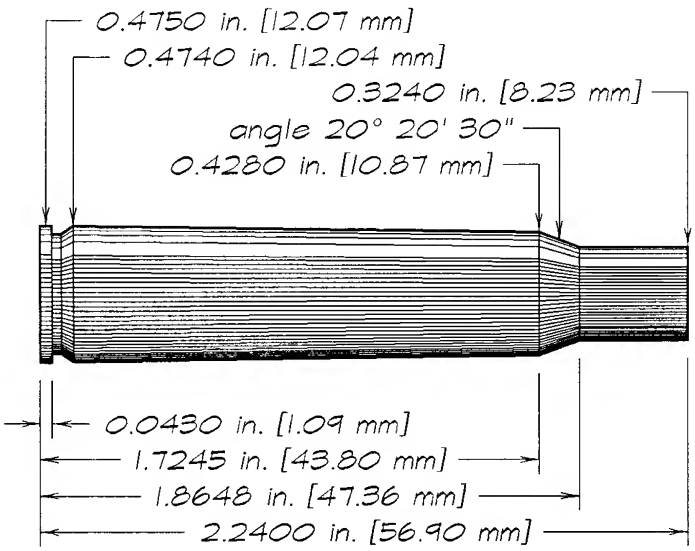
.284 bullet displaces 16.02 grains per inch.

Use factory .275 HV brass. Or resize 7x57mm or 8x57mm Mauser brass full-length in .275 HV sizer die, then fire-form with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.275 Rigby High-Velocity (ICI Metals Ltd dwg)

solid:
702 gr brass
82 gr water

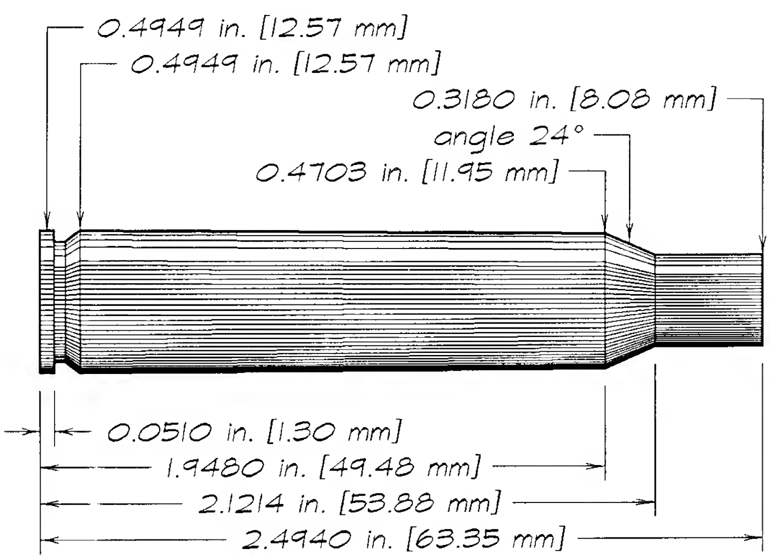


.284 bullet displaces
16.02 grains per inch.

Use factory .275 HV brass. Or resize 7x57mm Mauser or 8x57mm Mauser brass full-length in .275 HV sizer die, then fire-form with inert filler.

.276 Newton (Newton drawing*)

solid:
869 gr brass
102 gr water



.284 bullet displaces
16.02 grains per inch.

Form from 10.75x68mm brass, in RCBS form-and-trim dies.

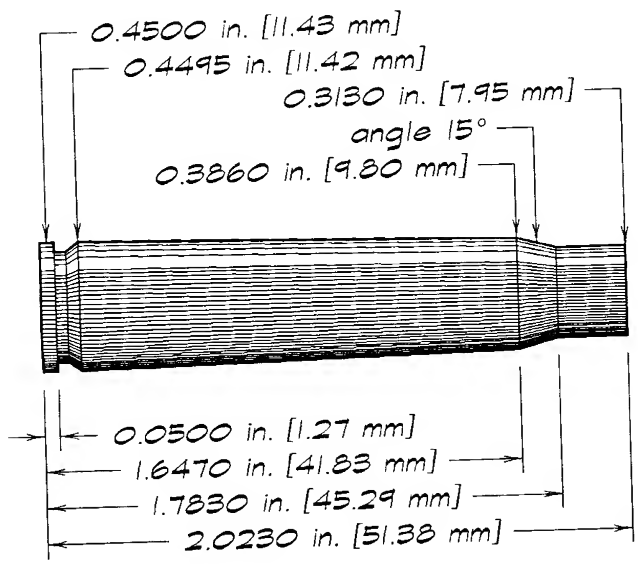
*derived from Newton factory dimensions for .276 Newton chamber

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.276 Pedersen

(Frankford Arsenal dwg)

solid:
571 gr brass
67 gr water



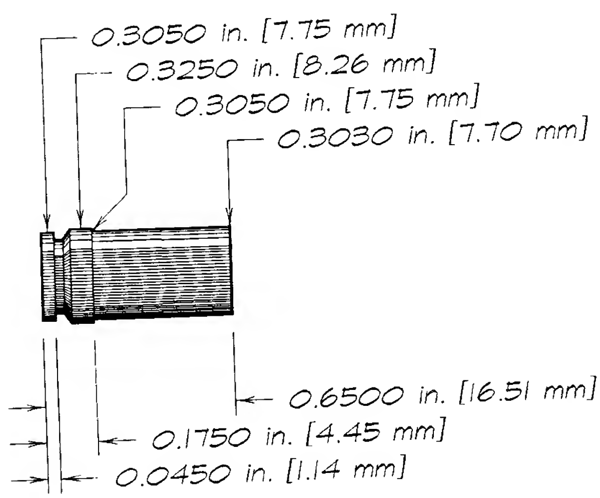
.285 bullet displaces 16.13 grains per inch.

This case is a historical curiosity, interesting mainly to researchers and collectors. It was an experimental military cartridge, for an experimental military rifle. Both failed to gain approval.

.28 BSA Auto Pistol Cartridge

(Kynoch drawing, 1921)

solid:
105 gr brass
12 gr water



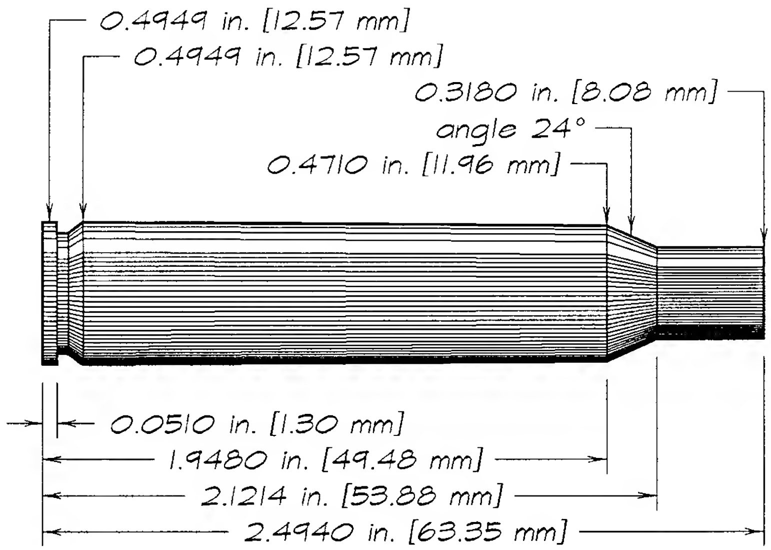
If you know anything whatsoever about this cartridge, please let me know.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.28 Newton

(Newton drawing*)

solid:
870 gr brass
102 gr water



.287 bullet displaces
16.36 grains per inch.

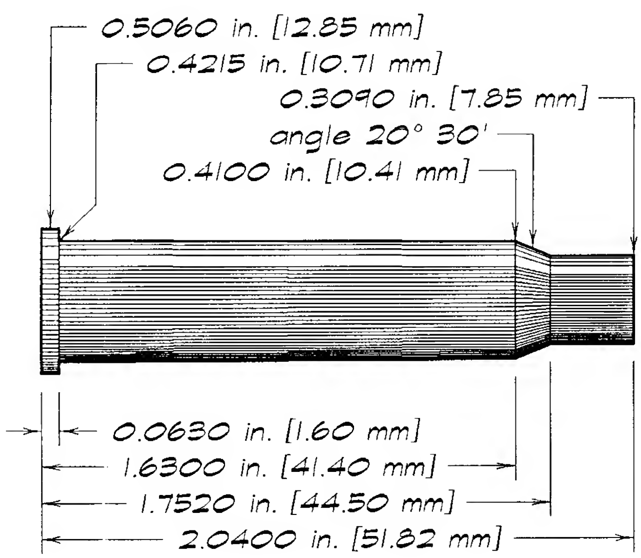
Form from 10.75x68mm brass, in RCBS form-and-trim dies.

*derived from Newton factory dimensions for .28 Newton chamber

.28-30 Davis Improved

(designer's specs)

solid:
553 gr brass
65 gr water



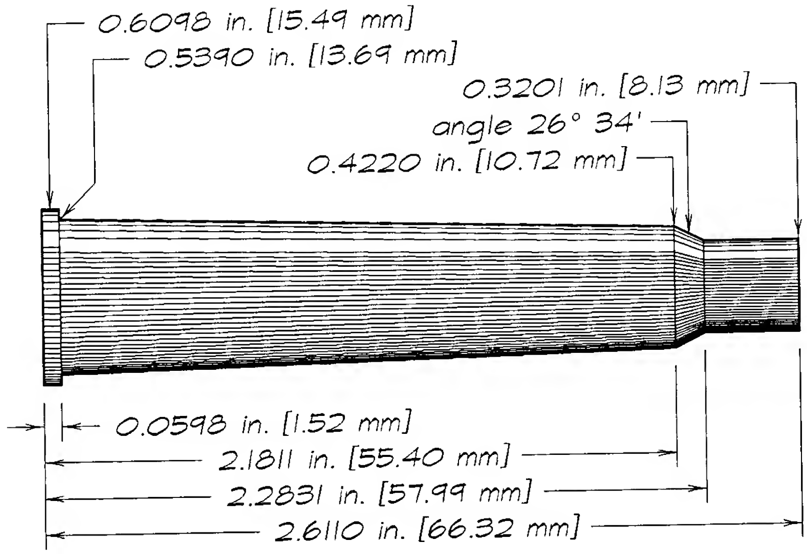
.284 bullet displaces
16.02m grains per inch.

Resize .30-30 Winchester or 7-30 Waters brass full-length in .28-30 DI sizer die. Fire-form with inert filler. Trim if necessary. Deburr.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.280 Flanged Nitro Express

(CIP maximums)



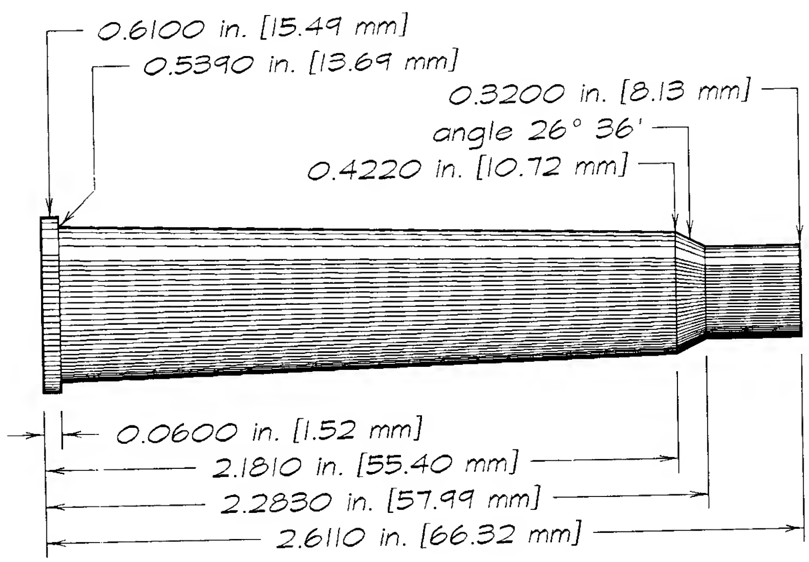
solid:
952 gr brass
112 gr water

.287 bullet displaces
16.36 grains per inch.

Use factory .280 Flanged NE brass. Or anneal forward ½ inch of .450 NE Basic brass and form in RCBS form and trim dies. Ream inside neck, in RCBS ream die.

.280 Flanged Nitro Express

(ICI Metals Ltd dwg)



solid:
952 gr brass
112 gr water

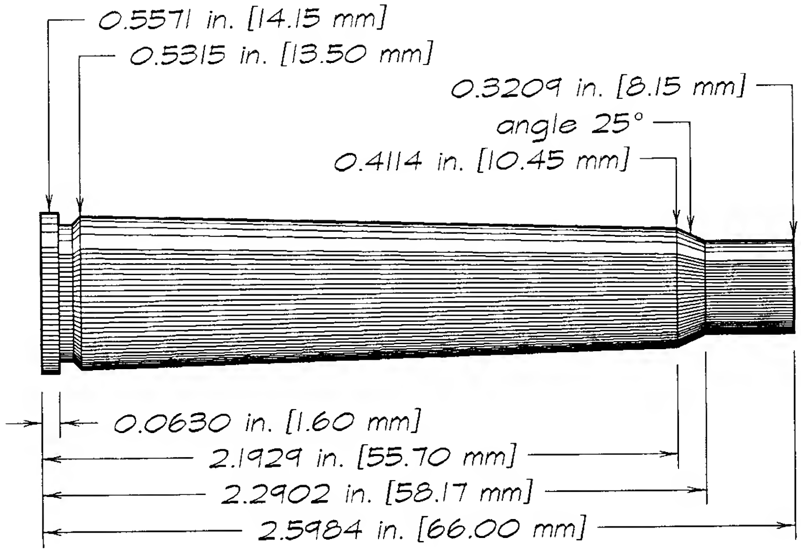
.287 bullet displaces
16.36 grains per inch.

Use factory .280 Flanged NE brass. Or anneal forward 1/2 inch of .450 NE Basic brass and form in RCBS form and trim dies. Ream inside neck, in RCBS ream die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.280 Halger (Triebel maximums)

solid:
938 gr brass
110 gr water

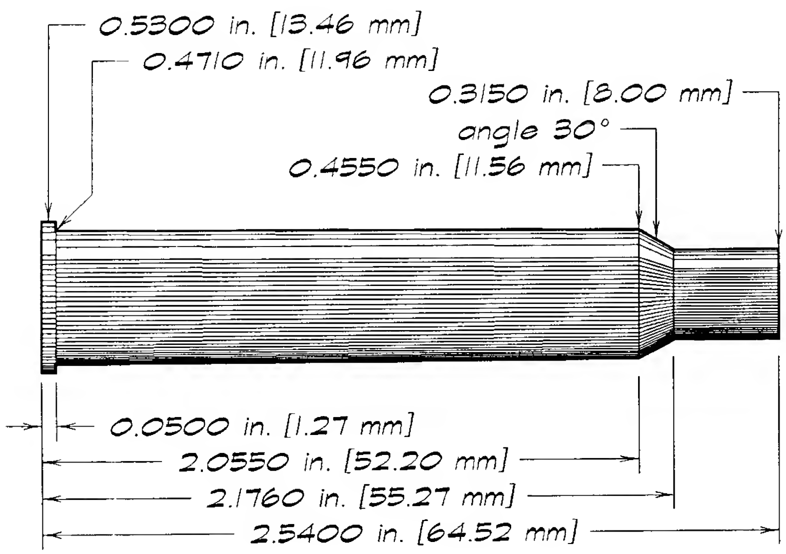


.284 bullet displaces 16.02 grains per inch.

Form from Huntington's .280 Ross cylindrical brass, in RCBS form and trim dies.

.280 Improved Rimmed (designer's specs)

solid:
803 gr brass
94 gr water



.284 bullet displaces 16.02 grains per inch.

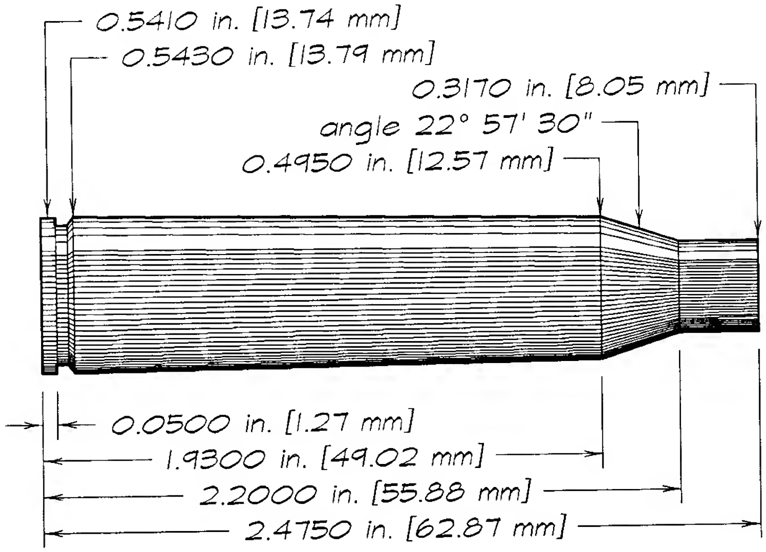
Trim .400-.350 NE brass to 2.6 inches and resize full-length in .280 RCBS Improved sizer die. Fire-form with inert filler, trim to 2.54 inches, and deburr.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.280 Jeffery

(Kynoch drawing, 1913)

solid:
1,021 gr brass
120 gr water



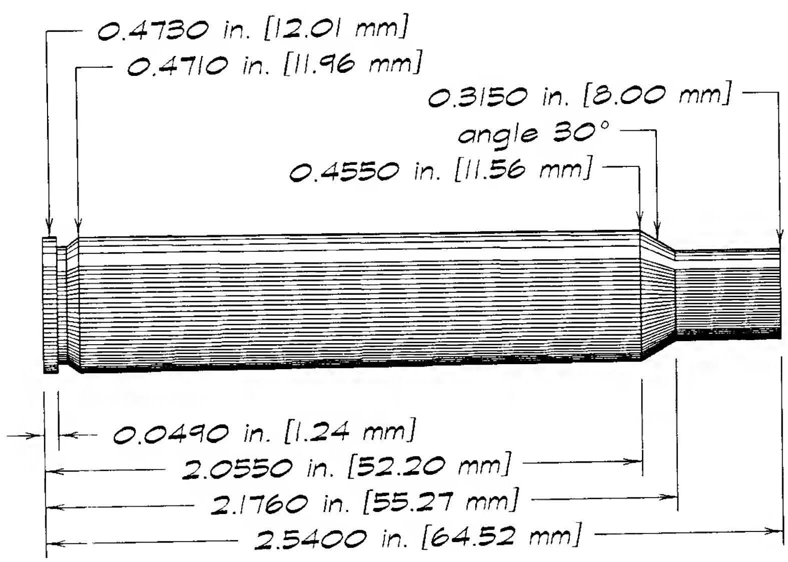
.287 bullet displaces
16.36 grains per inch.

Anneal neck and shoulder of .404 Jeffery brass or forward portion of HDS .404 Basic brass. Form and trim in RCBS form and trim dies. Deburr.

.280 RCBS Improved

(RCBS drawing)

solid:
826 gr brass
97 gr water



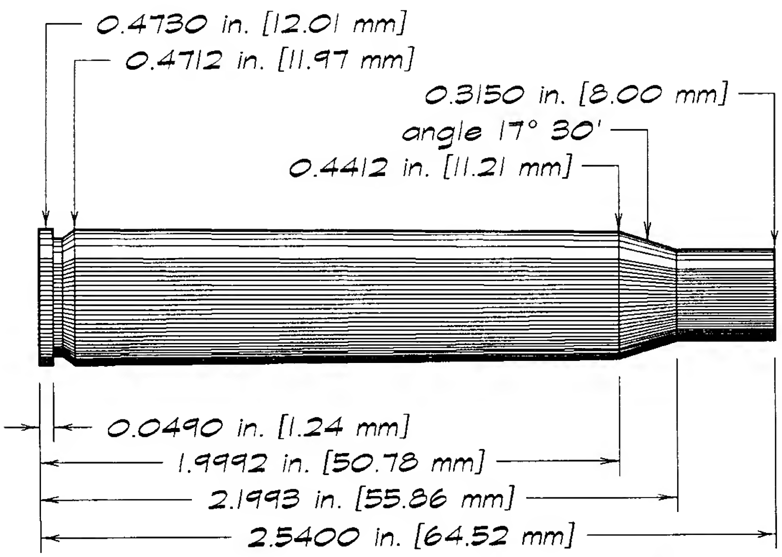
.284 bullet displaces
16.02 grains per inch.

Fire-form .280 Remington brass with inert filler. Or fire .280 Remington ammunition in .280 RCBS chamber.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.280 Remington (7mm Express, 7mm-06 Remington) (SAAMI maximums)

solid:
810 gr brass
95 gr water

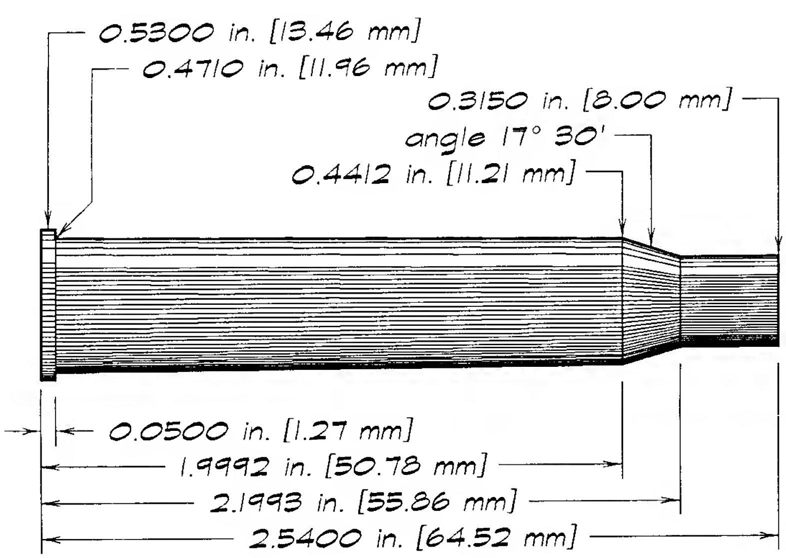


.284 bullet displaces
16.02 grains per inch.

Factory brass should be just about everywhere. But if it isn't, fire-form .25-06 Remington or .270 Winchester with inert filler. Or resize .30-06 Springfield brass full-length in .280 Remington sizer die if a sacrifice in case length is acceptable. Or form from 7x64mm Brenneke brass, in RCBS form die.

.280 Remington Rimmed (designer's specs)

solid:
755 gr brass
89 gr water



.284 bullet displaces
16.02 grains per inch.

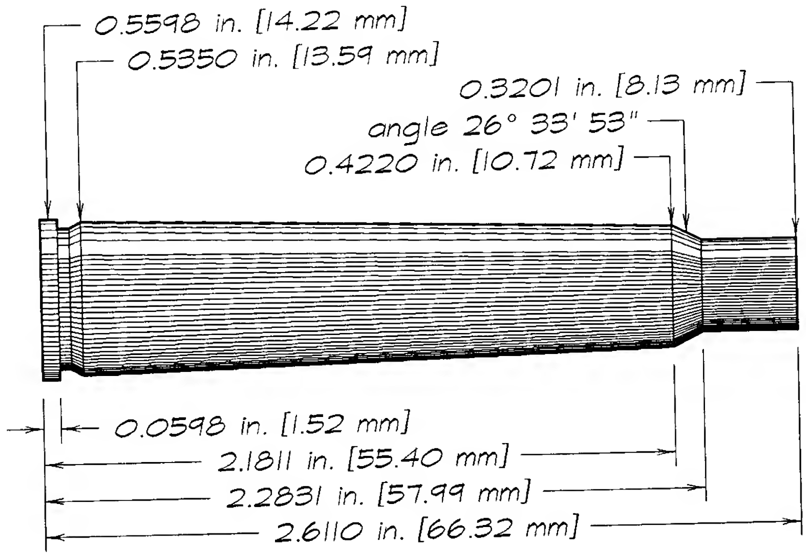
Trim .450-.350 NE brass to 2.6 inches and resize full-length in .280 Remington sizer die. Fire-form with inert filler, trim to 2.54 inches, and deburr.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.280 Rimless Nitro Express Ross

(CIP maximums)

solid:
962 gr brass
113 gr water



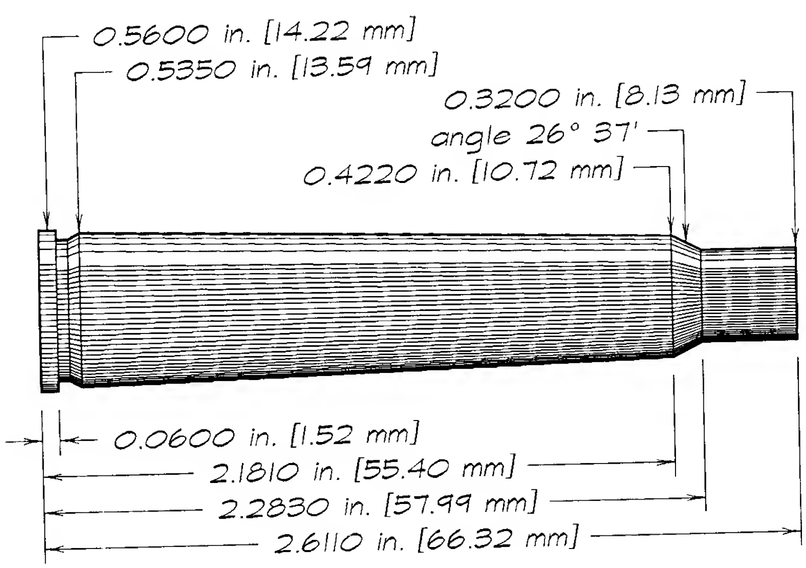
.287 bullet displaces 16.36 grains per inch.

Use factory .280 Ross brass. Or form from Ross Basic or Remington Spanish Basic brass, in respective RCBS form and trim dies. Ream neck, in neck-ream die.

.280 Rimless Nitro Express (Ross)

(ICI Metals Ltd dwg)

solid:
962 gr brass
113 gr water



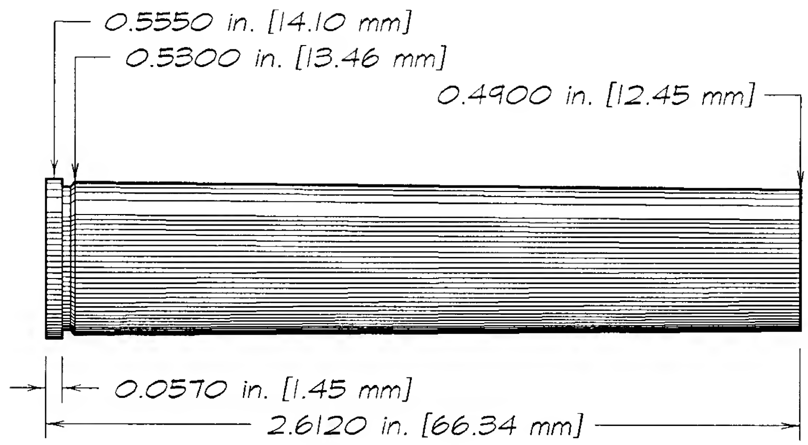
.287 bullet displaces 16.36 grains per inch.

Use factory .280 Ross brass. Or form from Ross Basic or Remington Spanish Basic brass, in respective RCBS form and trim dies. Ream neck, in neck-ream die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.280 Ross HDS Cylindrical (HDS specimen)

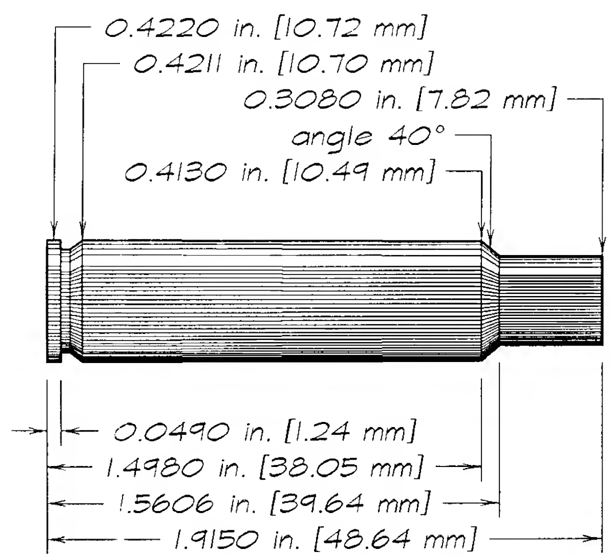
solid:
1,222 gr brass
143 gr water



The dimensions of the rim, base, and length of this BASIC case are almost certain to be slightly different from the corresponding MAXIMUM dimensions specified for any case you plan to form from this one. Don't let the normal variation of a few ten-thousandths of an inch -- even a few thousandths -- worry you.

.284 Barnburner (designer's specs)

solid:
507 gr brass
59 gr water



.284 bullet displaces 16.02 grains per inch.

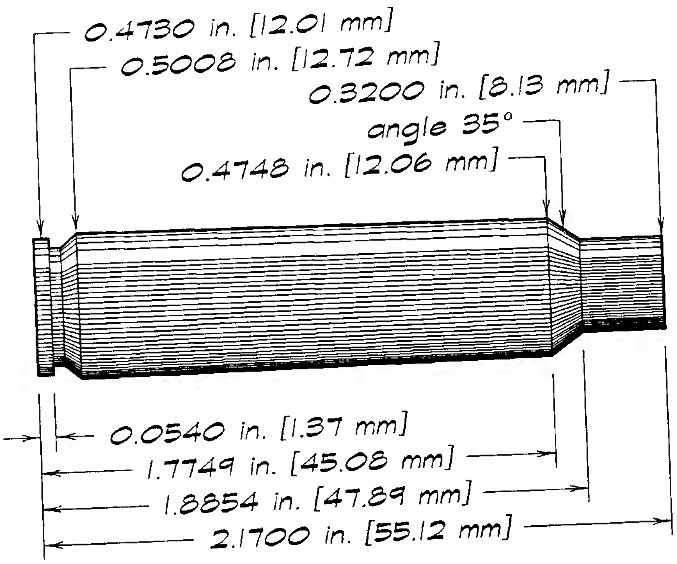
Anneal neck and shoulder of .30 Remington brass. Form and trim in RCBS form-and-trim die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.284 Winchester

(SAAMI maximums)

solid:
786 gr brass
92 gr water



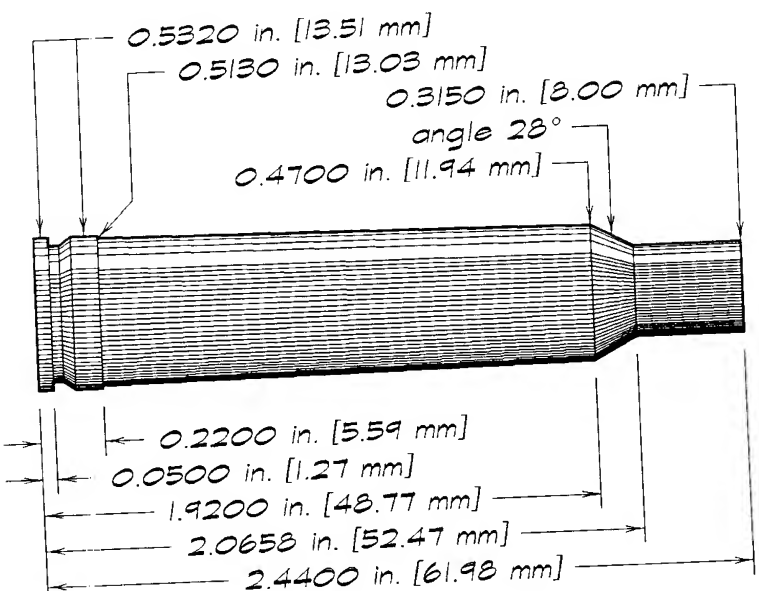
.284 bullet displaces
16.02 grains per inch.

Use factory-made .284 Winchester brass. There is no easily modifiable substitute.

.285 Luft Magnum

(Speer manual number 4)

solid:
928 gr brass
109 gr water



.284 bullet displaces
16.02 grains per inch.

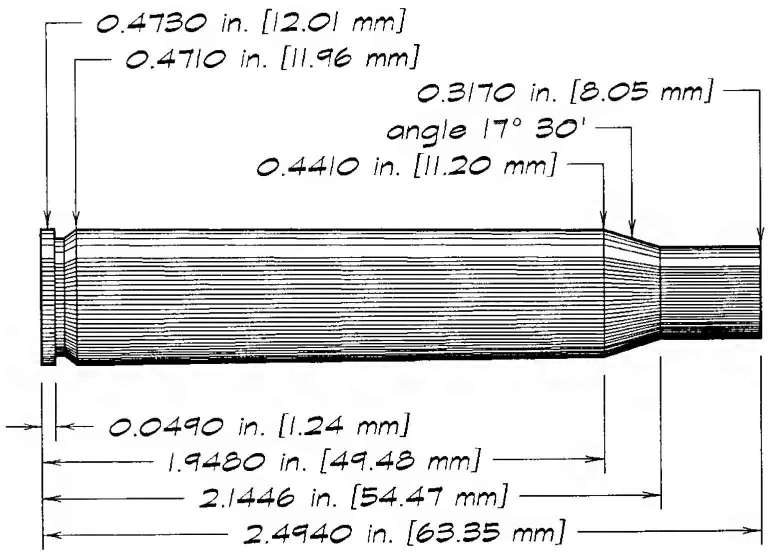
Anneal neck and shoulder of .264 or .300 Winchester Magnum or 7mm Remington Magnum brass. Resize full-length in .285 Luft Magnum sizer die. Fire-form with inert filler. Trim, then deburr.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.285 OKH

(designer's specs)

solid:
792 gr brass
93 gr water



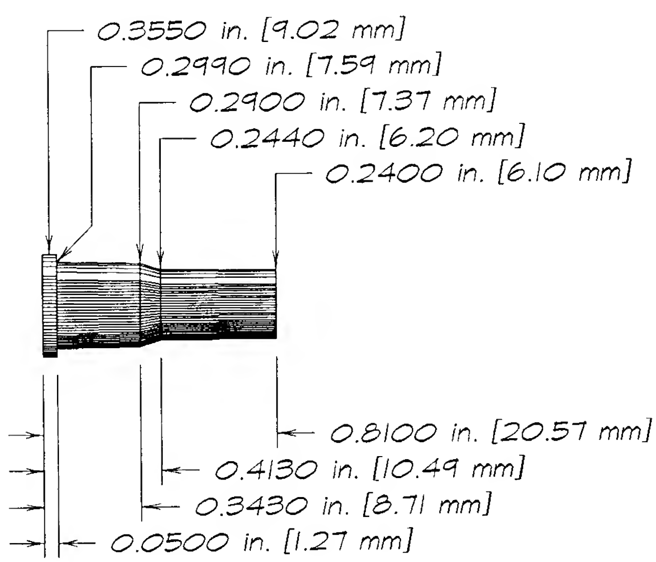
.284 bullet displaces 16.02 grains per inch.

Use .280 Remington (or 7mm Express Remington) brass. Or resize .30-06 Springfield brass full-length in 7mm-06 sizer die.

.297-.230 (Morris) Long

(Birmingham Proof House)

solid:
95 gr brass
11 gr water



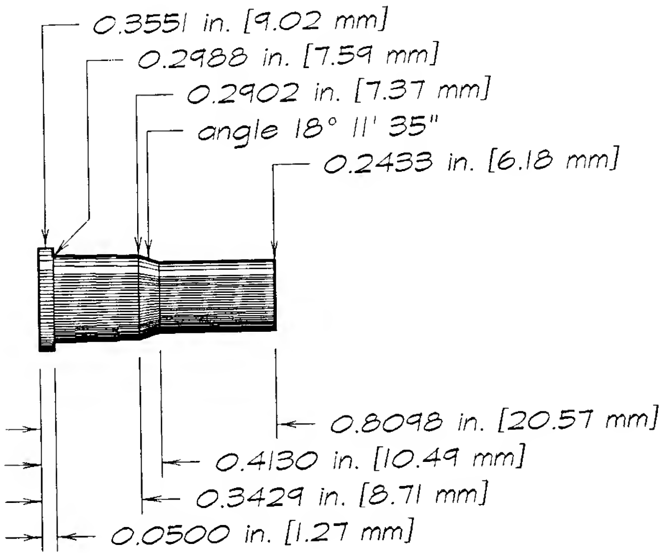
.225 bullet displaces 10.06 grains per inch.

Use factory .297-.230 Long brass. Or shorten .22 Hornet brass to 0.8 inch long and resize full-length in .297-.230 Long sizer die. Trim to 0.80 inch long; deburr.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.297-.230 Morris Long

(CIP maximums)



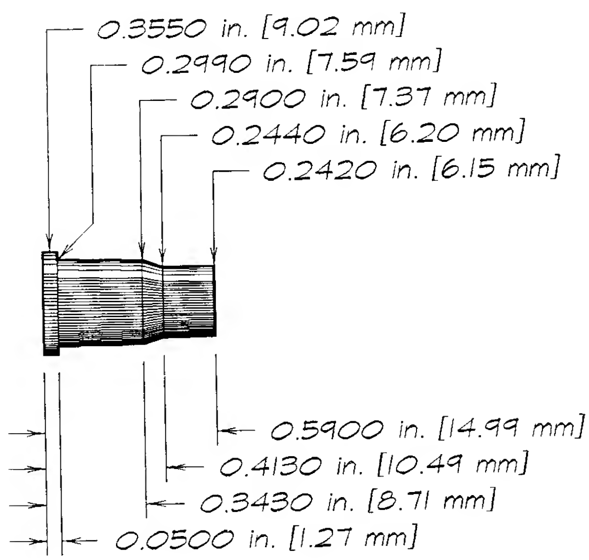
solid:
96 gr brass
11 gr water

.225 bullet displaces
10.06 grains per inch.

Use factory .297-.230 Long brass. Or shorten .22 Hornet brass to 0.8 inch long and resize full-length in .297-.230 Long sizer die. Trim to 0.80 inch long; deburr.

.297-.230 (Morris) Short

(Birmingham Proof House)



solid:
76 gr brass
9 gr water

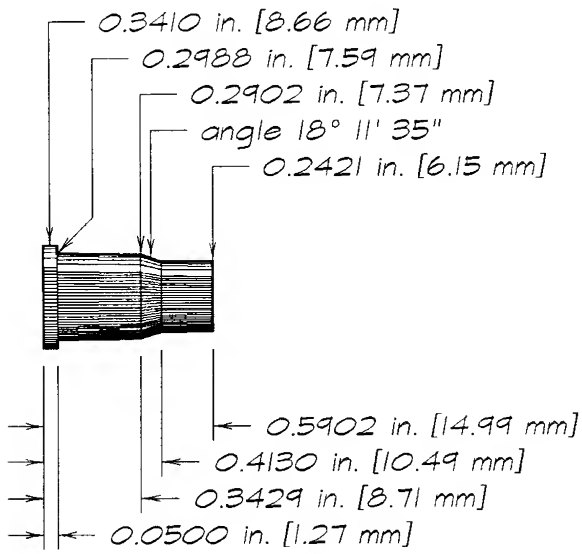
.225 bullet displaces
10.06 grains per inch.

Use factory .297-.230 Short brass. Or trim .297-.230 Long brass to 0.59 inch and deburr. Or shorten .22 Hornet brass to 0.59 inch long, size full-length in .297-.230 Short sizer die, and deburr.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.297-.230 Morris Short

(CIP maximums)



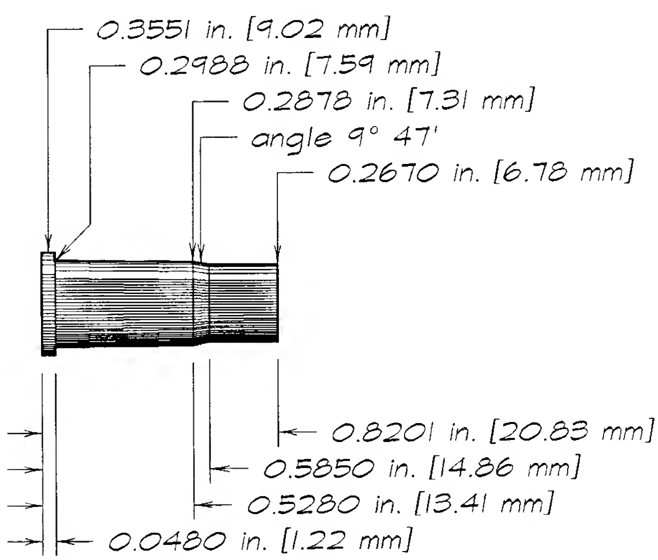
solid:
76 gr brass
9 gr water

.225 bullet displaces
10.06 grains per inch.

Use factory .297-.230 Short brass. Or trim .297-.230 Long brass to 0.59 inch long. Or shorten .22 Hornet brass to 0.59 inch long, size full-length in .297-.230 Short sizer die, and deburr.

.297-.250 Rook Rifle

(CIP maximums)



solid:
117 gr brass
14 gr water

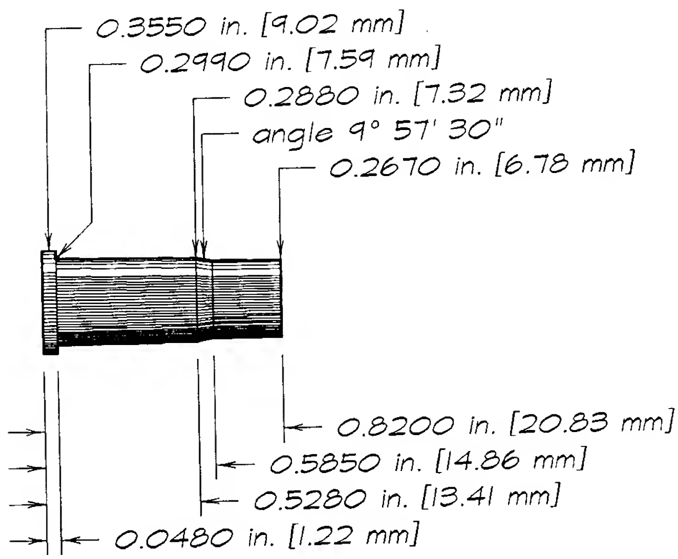
.251 bullet displaces
12.51 grains per inch.

Use factory .297-.250 Rook brass. Or form from .22 Hornet brass, in RCBS form and trim dies. Deburr.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.297-.250

(ICI Metals Ltd dwg)



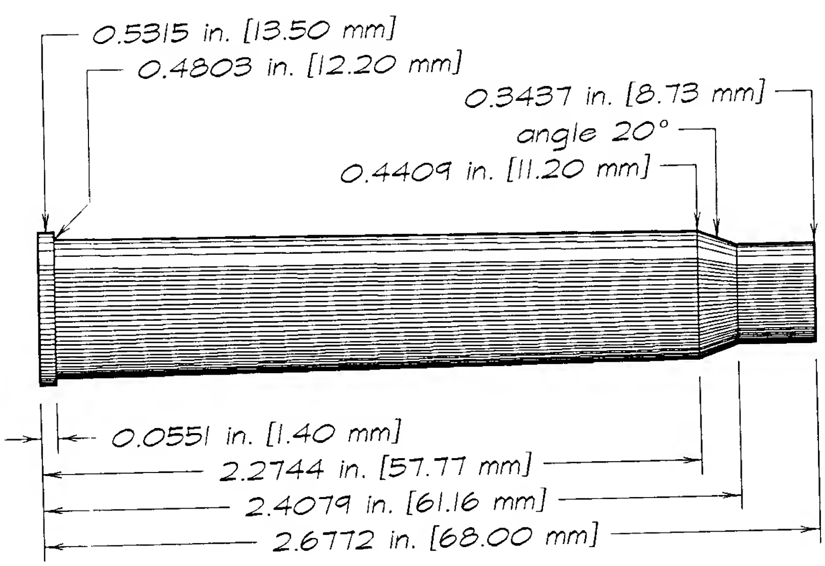
solid:
117 gr brass
14 gr water

.251 bullet displaces
12.51 grains per inch.

Use factory .297-.250 Rook brass. Or form from .22 Hornet brass, in RCBS form-and-trim die.

.30 Blaser Rimmed

(Dynamit Nobel drawing)



solid:
928 gr brass
109 gr water

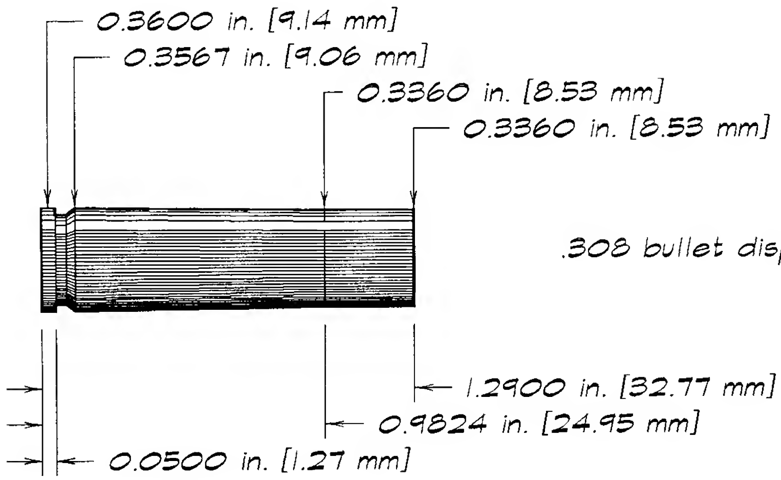
.309 bullet displaces
18.96 grains per inch.

Use factory .30R Blaser brass.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.30 Carbine (.30 M1 Carbine, .30 US Carbine) (SAAMI maximums)

solid:
263 gr brass
31 gr water

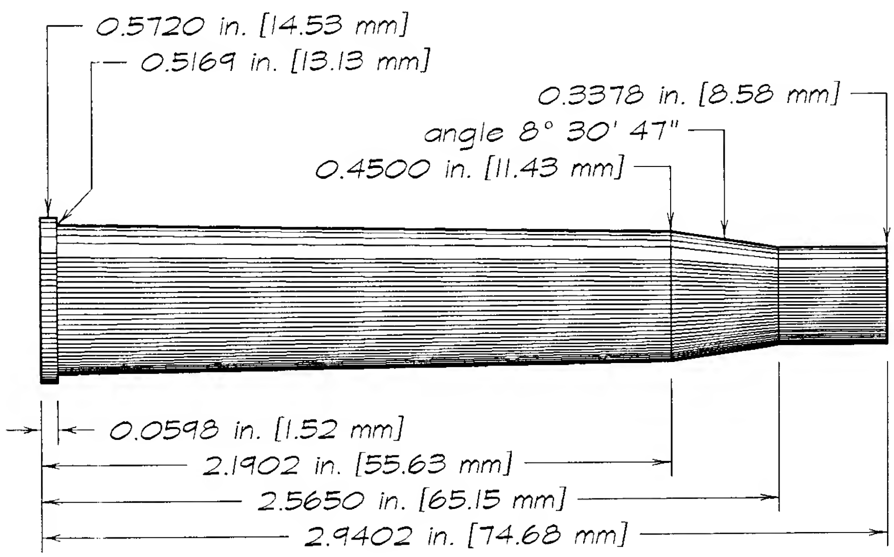


.308 bullet displaces 18.84 grains per inch.

Use factory-made .30 Carbine cases. No easily modifiable substitute is available.

.30 Super Flanged Holland & Holland (CIP maximums)

solid:
1,058 gr brass
124 gr water



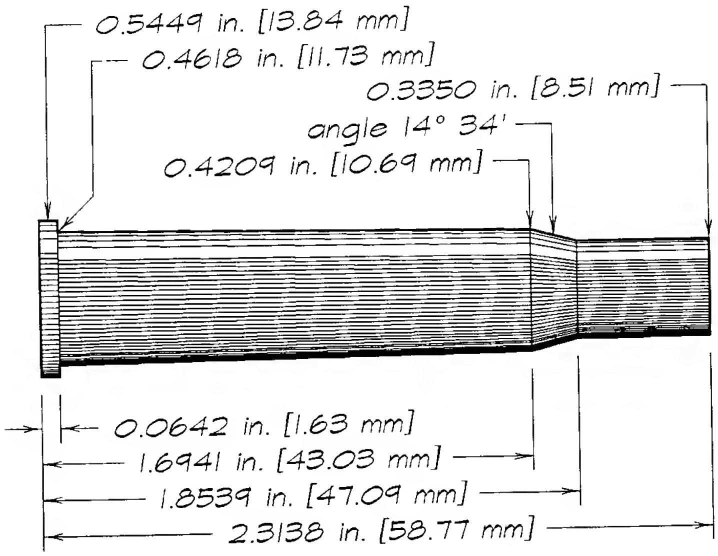
.308 bullet displaces
18.84 grains per inch

Use factory .30 Super Flanged H&H brass. Or anneal neck and shoulder of basic .375 Flanged brass and form in RCBS form, trim, and neck-ream dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.30 Flanged Nitro Express Purdey

(CIP maximums)



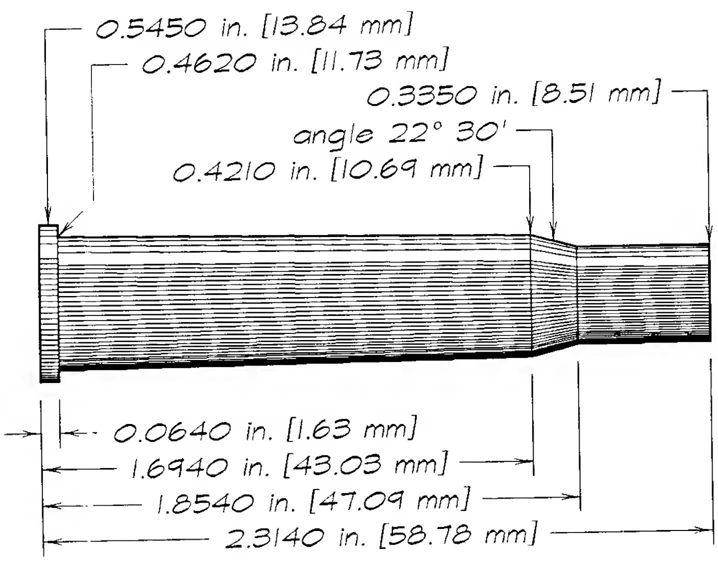
solid:
689 gr brass
81 gr water

.308 bullet displaces
18.84 grains per inch.

Use factory .30 Flanged NE brass. Or size the essentially similar .30-40 Krag brass full-length in .30 Flanged NE sizer die, then fire-form with inert filler.

.30 Flanged Nitro Express (Purdey)

(ICI Metals Ltd dwg)



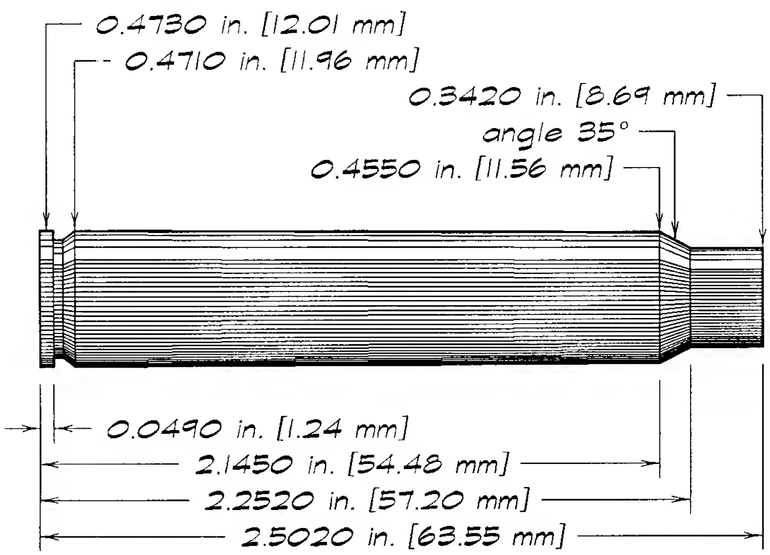
solid:
689 gr brass
81 gr water

.308 bullet displaces
18.84 grains per inch.

Use .30 Flanged NE brass or the essentially similar .30-40 Krag brass.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.30 Gibbs (David J LeGate)

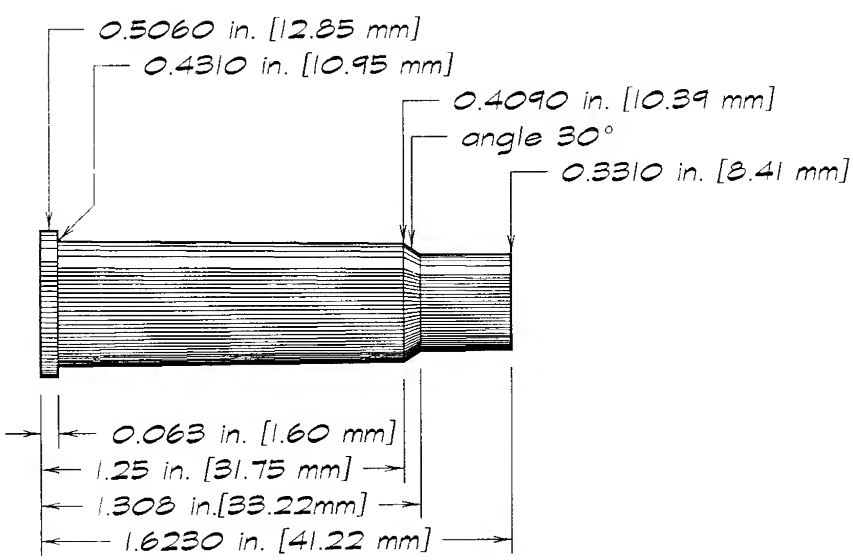


solid:
856 gr brass
100 gr water

.308 bullet displaces
18.84 grains per inch.

Fire-form .30-06 Springfield brass with inert filler. Or resize .35 Whelen brass full-length in .30 Gibbs sizer die, then fire-form with inert filler.

.30 Herrett (RCBS drawing)



solid:
440 gr brass
52 gr water

.308 bullet displaces
18.84 grains per inch.

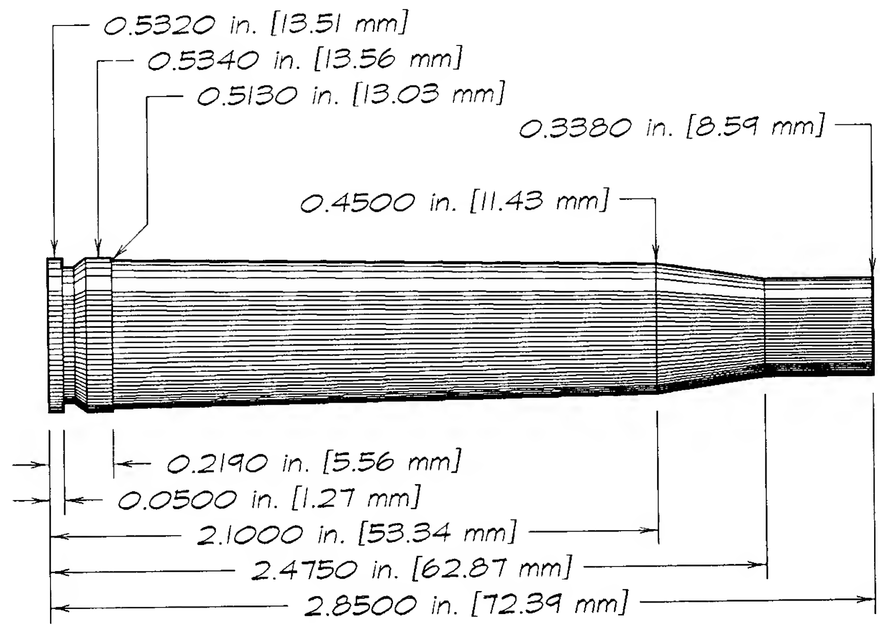
Form from .30-30 Winchester brass, in RCBS form and trim dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.30 Holland Super Magnum "Rimless"

(ICI Metals Ltd dwgs)

solid:
1,037 gr brass
122 gr water



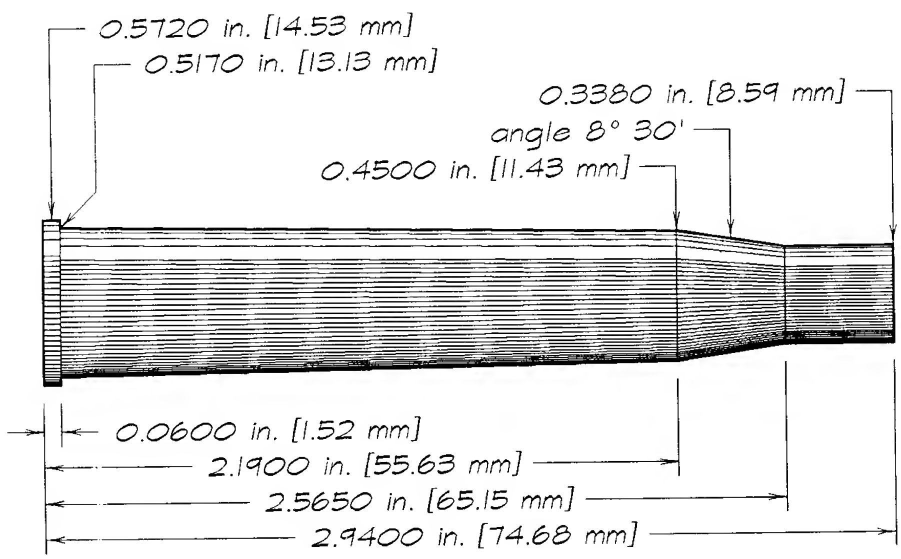
.308 bullet displaces 18.84 grains per inch.

Use .300 H&H Magnum brass. Or form from .375 H&H Magnum brass, in RCBS form and trim dies.

.30 Holland Super .30 Magnum Flanged

(ICI Metals Ltd dwg)

solid:
1,058 gr brass
124 gr water



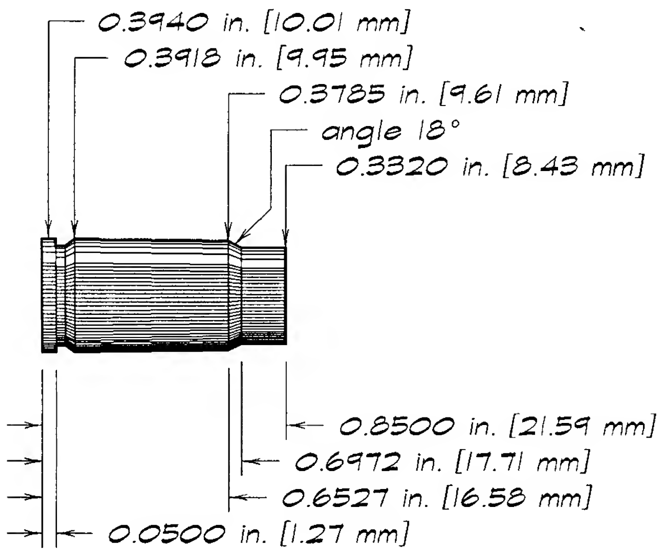
.308 bullet displaces 18.84 grains per inch.

Use .30 Super Flanged brass. Or anneal neck and shoulder of .375 Flanged Basic brass. Form and trim in RCBS form and trim dies. Ream necks, in RCBS ream die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.30 Luger (7.65mm)

(SAAMI maximums)



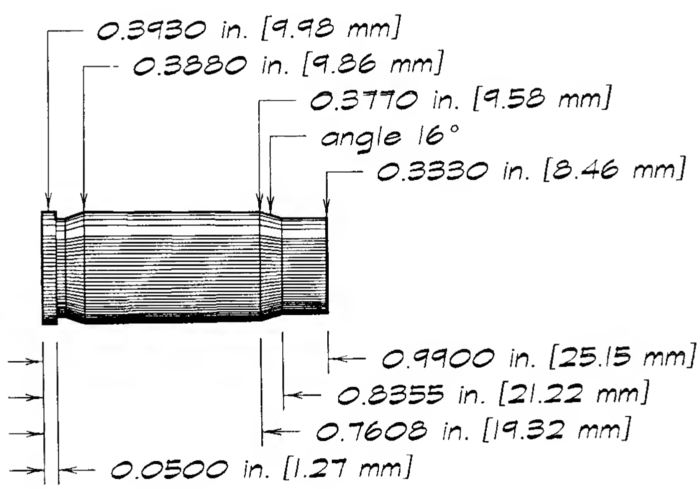
solid:
200 gr brass
23 gr water

.308 bullet displaces
18.84 grains per inch.

Use Boxer-primed .30 Luger brass. Or form from .223 Remington brass, in RCBS form-and-trim die. Ream neck, in RCBS ream die. Deburr.

.30 Mauser (7.63mm Mauser)

(SAAMI maximums, 1960)



solid:
232 gr brass
27 gr water

.309 bullet displaces
18,96 grains per inch.

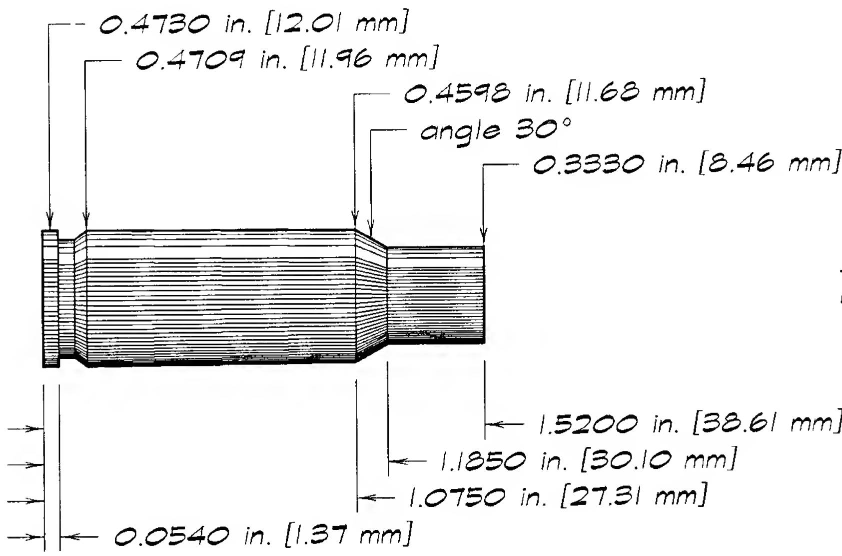
Anneal neck and shoulder of .223 Remington brass. Form in RCBS form and trim dies. Deburr.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.30 MS

(Remington drawing, 1978)

solid:
445 gr brass
52 gr water



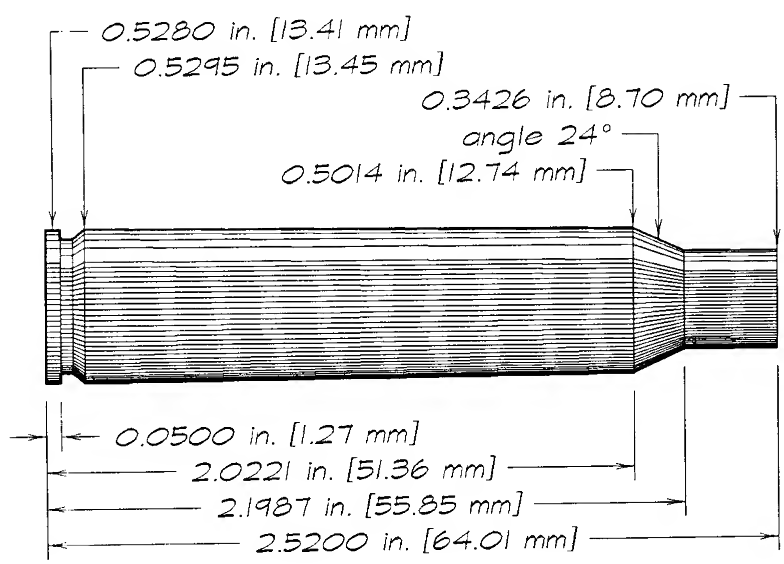
.308 bullet displaces
18.84 grains per inch.

Anneal shoulder and upper body of .308 Winchester brass and form in RCBS form, trim, and neck-ream dies.

.30 Newton

(Western Ctg Co dwg)

solid:
1,023 gr brass
120 gr water

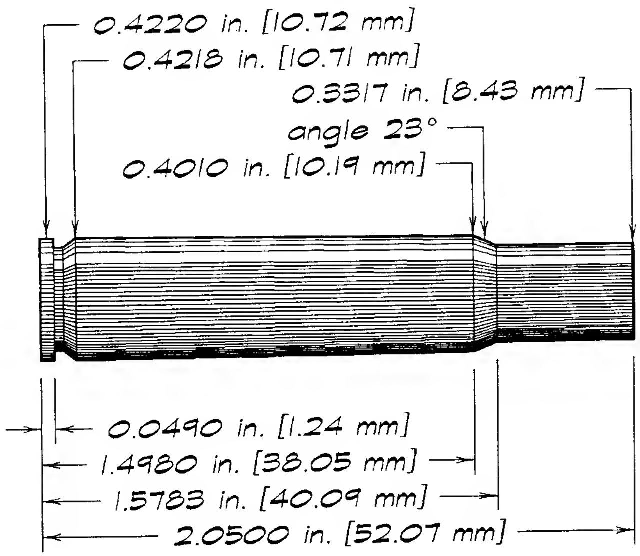


.308 bullet displaces
18.84 grains per inch.

Form from 8x68mm S brass, in RCBS form and trim dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.30 Remington (SAAMI maximums)

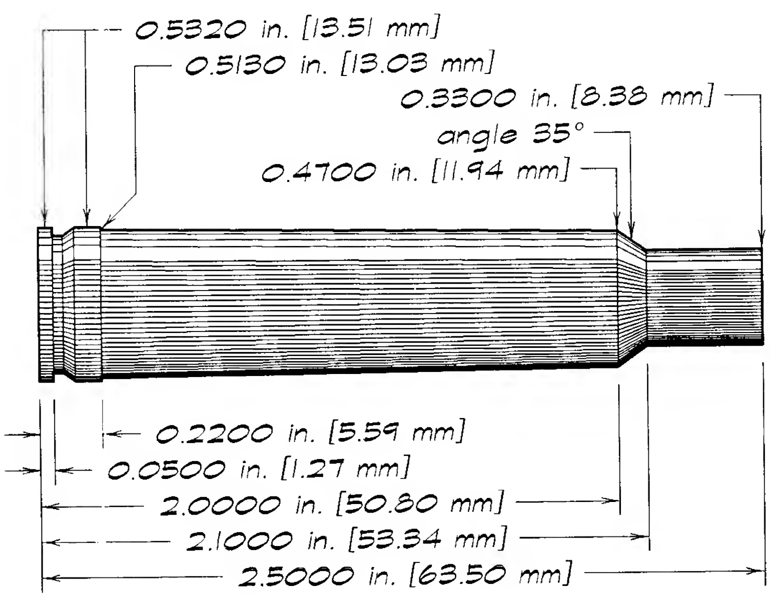


solid:
537 gr brass
63 gr water

.307 bullet displaces
18.72 grains per inch.

Factory-made .30 Remington brass should be just as plentiful and available as the .32 Remington brass you can form into .30 Remington, in an RCBS form die.

.30 Short Magnum (Speer manual number 4)



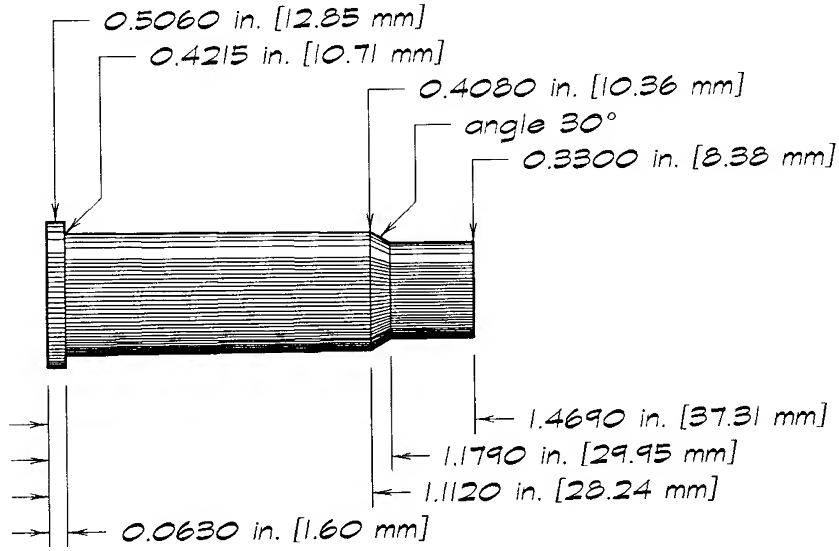
solid:
963 gr brass
113 gr water

.308 bullet displaces
18.84 grains per inch.

Resize .300 Winchester Magnum brass full-length in .30 Short Magnum sizer die, trim, and deburr. (I'd look into rechambering the rifle to .300 Winchester Magnum, if it were mine -- to make sure the new reamer would clean up the old chamber.)

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.30 Streaker (David J LeGate)

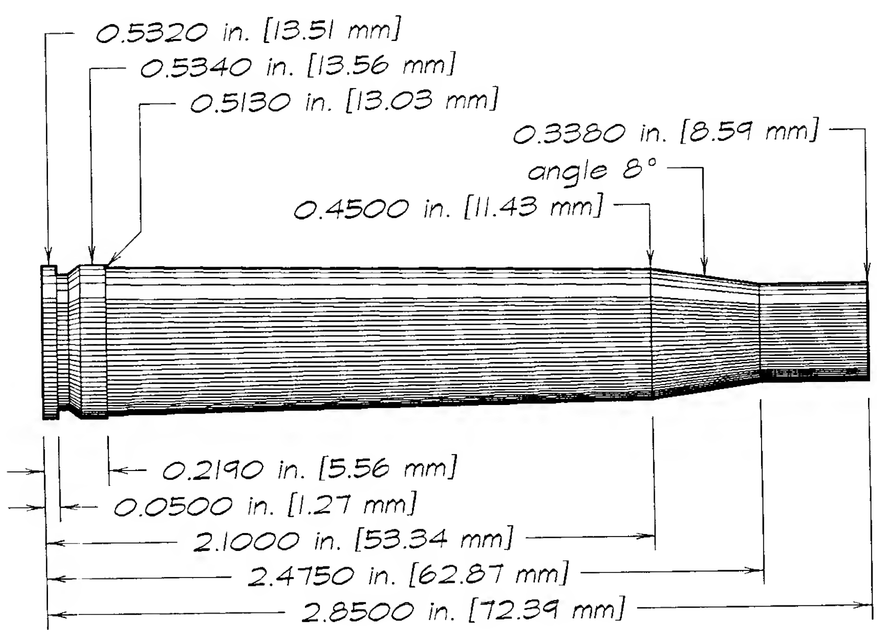


solid:
395 gr brass
46 gr water

.308 bullet displaces 18.84 grains per inch.

Anneal shoulder and upper body of .30-30 Winchester brass. Shorten to 1½ inches. Resize full-length in RCBS .30 Streaker sizer die (or in .30 Herrett die ground 1.4 inches shorter). Ream inside necks. Trim to 1.469 inches and deburr.

.30 Super Belted Rimless Holland & Holland (Birmingham Proof House)



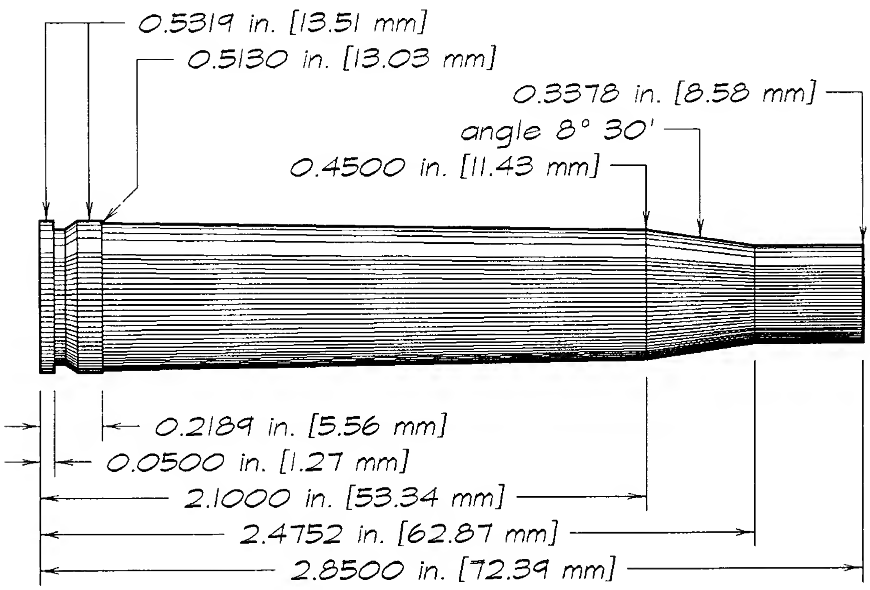
solid:
1,037 gr brass
122 gr water

.308 bullet displaces 18.84 grains per inch.

Use factory .30 Super Belted brass, or the essentially identical .300 H&H Magnum brass. Or form from .375 H&H Magnum brass, in RCBS form and trim dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.30 Super Belted Rimless Holland & Holland (CIP maximums)

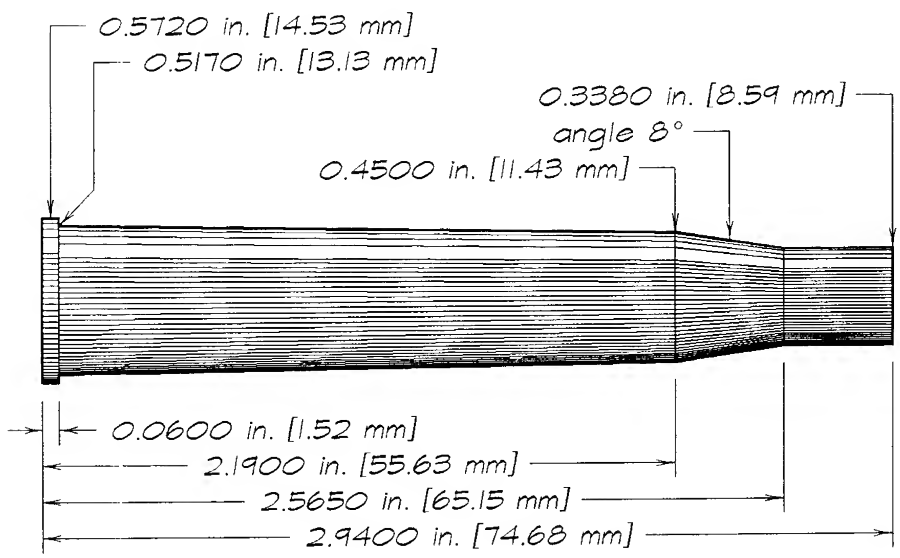


solid:
1,037 gr brass
122 gr water

.308 bullet displaces 18.84 grains per inch.

Use factory .30 Super brass, or the essentially identical .300 H&H Magnum brass.

.30 Super Flanged Holland & Holland (Birmingham Proof House)



solid:
1,058 gr brass
124 gr water

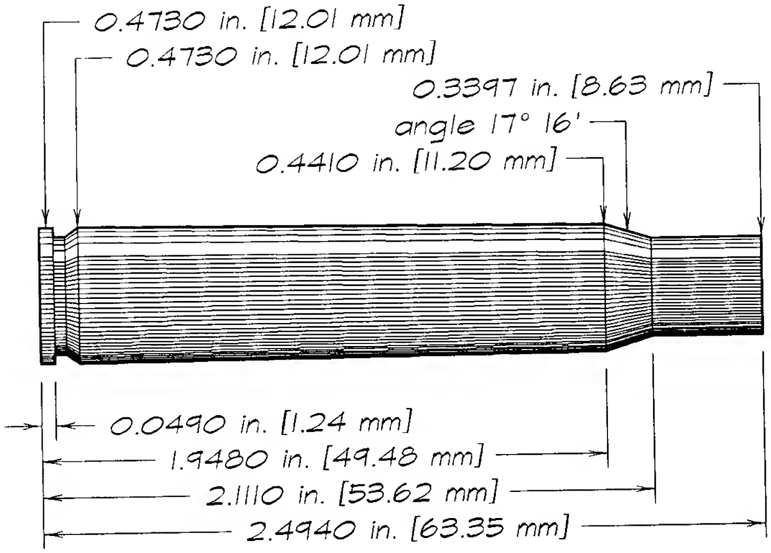
.308 bullet displaces 18.84 grains per inch.

Use factory .30 Super Flanged H&H brass. Or anneal neck and shoulder area of .375 Flanged Basic brass. Form in RCBS form, trim, and ream dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.30 US Rimless (.30-06 Springfield) (ICI Metals Ltd dwg)

solid:
816 gr brass
96 gr water

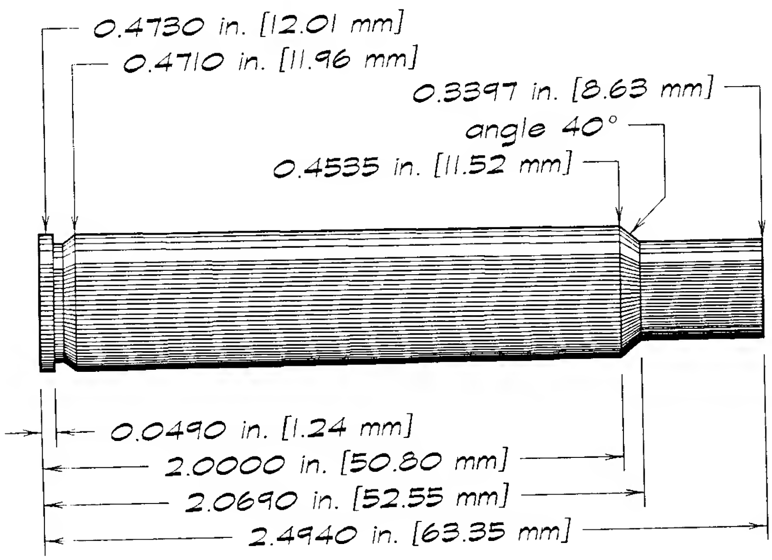


.308 bullet displaces
18.84 grains per inch.

Use .30-06 brass. Or anneal neck and shoulder of .35 Whelen, .270 Winchester, or .280 Remington brass. Resize .35 Whelen brass full-length in .30-06 sizer die. Fire-form .270 or .280 brass with inert filler. (Just about any factory or wildcat offspring of the .30-06 can become a .30-06 if it isn't too short.)

.30-06 Ackley Improved (Speer manual number 4)

solid:
827 gr brass
97 gr water

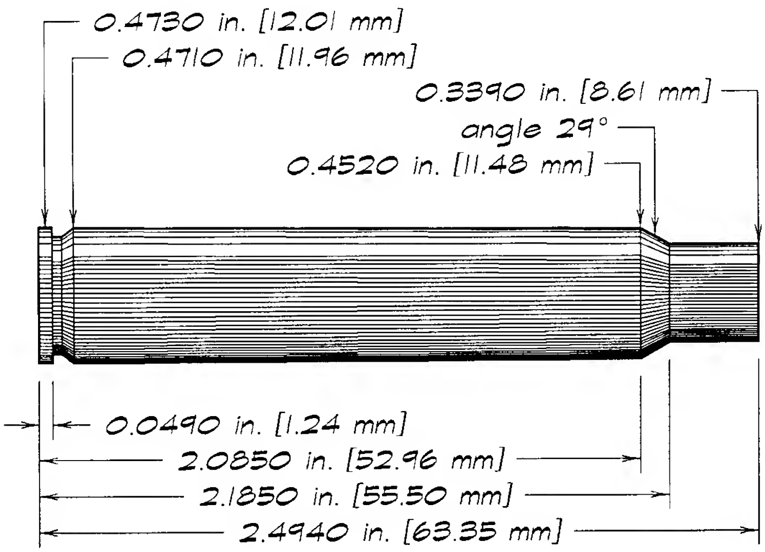


.308 bullet displaces
18.84 grains per inch.

Fire-form .30-06 Springfield ammunition in .30-06 Ackley Improved chamber. Or fire-form .30-06 Springfield brass with inert filler. Or resize .35 Whelen brass full-length in .30-06 Ackley Improved sizer die and fire-form with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.30-06 Max M (designer's specs)

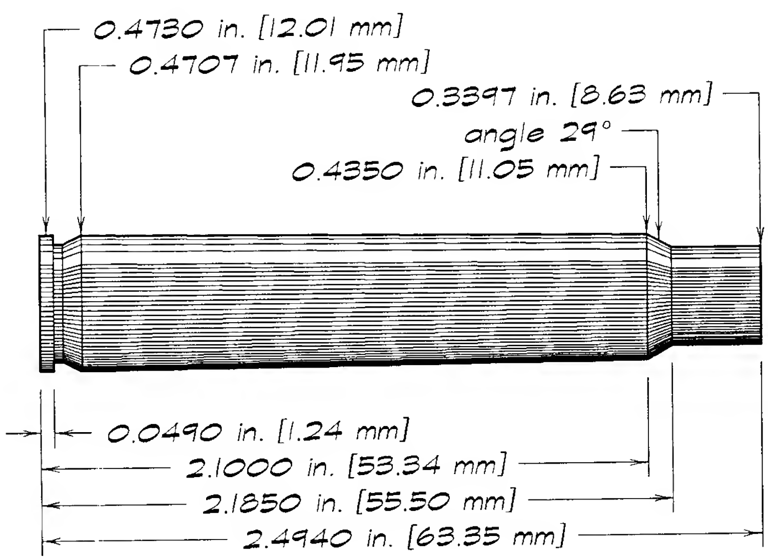


solid:
841 gr brass
99 gr water

.308 bullet displaces
18.84 grains per inch.

Anneal neck, shoulder, and upper body of .30-06 Springfield or .35 Whelen brass. Expand neck of .30-06 brass with 8mm expander, then neck-size in .30-06 Max M sizer die and fire-form with inert filler. Or resize .35 Whelen brass full-length in .30-06 Max M sizer die and fire-form with inert filler.

.30-06 Millin (designer's specs)



solid:
829 gr brass
97 gr water

.308 bullet displaces
18.84 grains per inch.

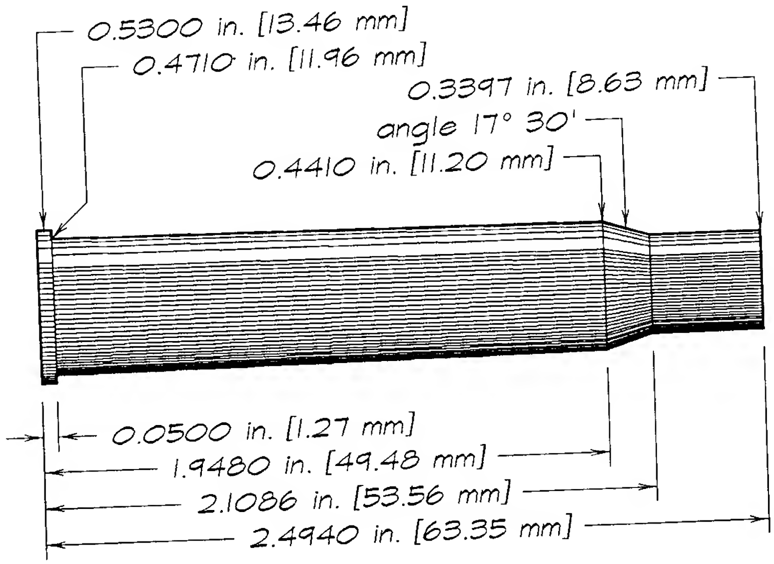
Millin fire-forms fired, unresized .30-06 Springfield brass that he has to force into his .30-06 Millin chamber. To form from unfired brass, resize .35 Whelen brass full-length in .30-06 Millin sizer die and fire-form with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

(designer's specs)

.30-06 Rimmed

solid:
811 gr brass
95 gr water



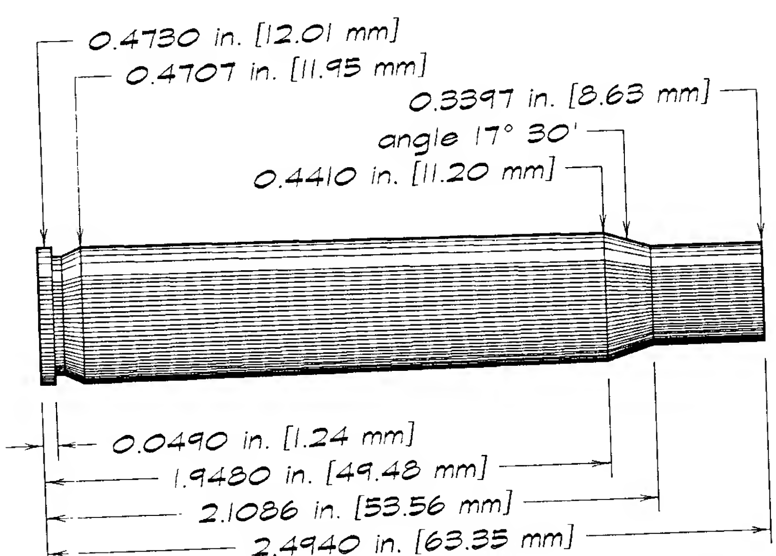
.308 bullet displaces
18.84 grains per inch.

Trim .400-.350 NE brass to 2.5 inches and resize full-length in .30-06 sizer die. Fire-form with inert filler. Trim to 2.49 inches and deburr.

(SAAMI maximums)

.30-06 Springfield

solid:
814 gr brass
95 gr water



.308 bullet displaces
18.84 grains per inch.

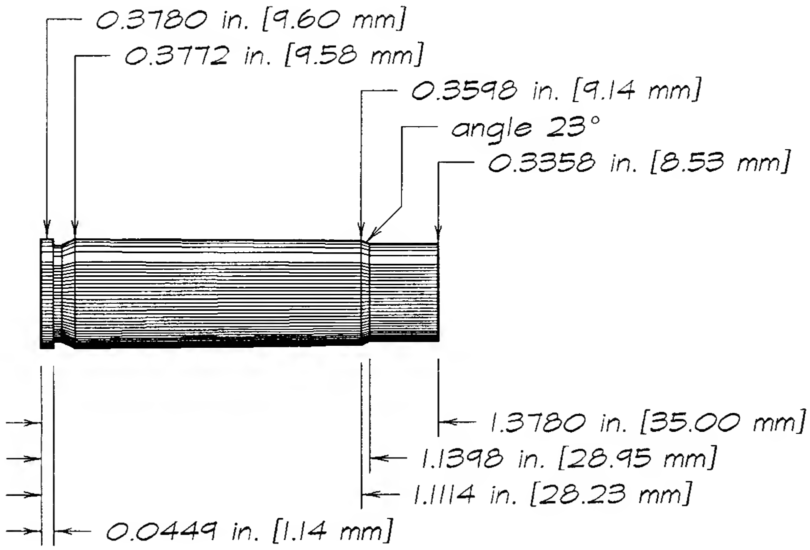
Anneal neck and shoulder of .35 Whelen, .270 Winchester, or .280 Remington case. Size .35 Whelen full-length in .30-06 sizer die. Fire-form .270 or .280 with inert filler. (Just about any factory or wildcat offspring of the .30-06, if it isn't too short, can become a .30-06.)

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.30-.223 Remington

(Triebel maximums)

solid:
309 gr brass
36 gr water



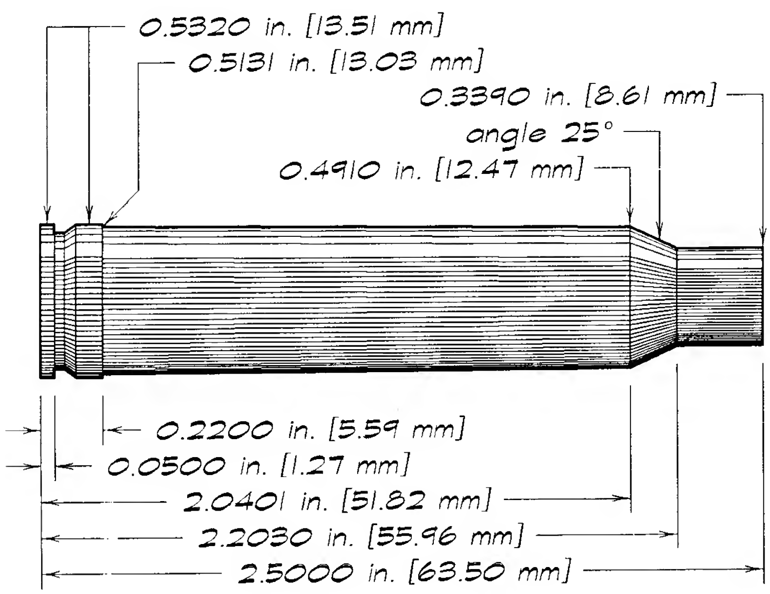
.308 bullet displaces
18.84 grains per inch.

Fire-form .223 Remington brass with inert filler.

.30-.264 Winchester Magnum

(designer's specs)

solid:
1,007 gr brass
118 gr water

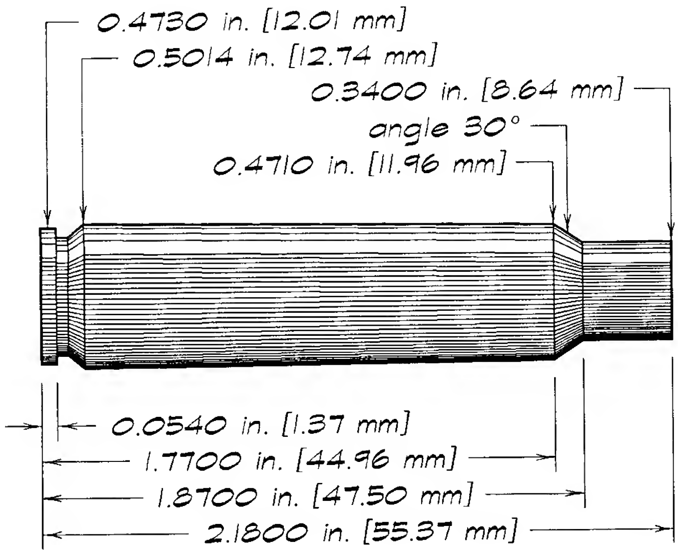


.308 bullet displaces
18.84 grains per inch.

Fire-form .264 Winchester brass with inert filler. Or resize .300 Winchester Magnum brass full-length in .30-.264 sizer die, trim to 2½ inches, and deburr. Or form from .300 H&H Magnum brass in RCBS form die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.30-.284 Davis Improved (designer's specs)

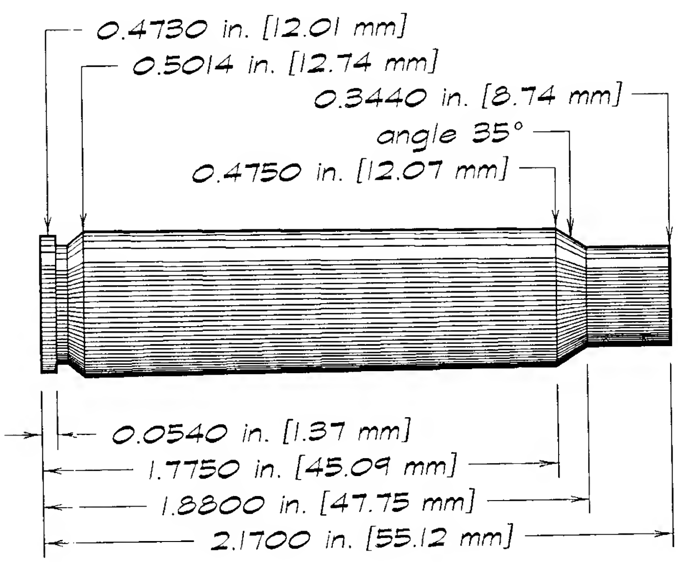


solid:
785 gr brass
92 gr water

.308 bullet displaces
18.84 grains per inch.

Fire-form .284 Winchester brass with inert filler.

.30-.284 Winchester (David J LeGate)



solid:
791 gr brass
93 gr water

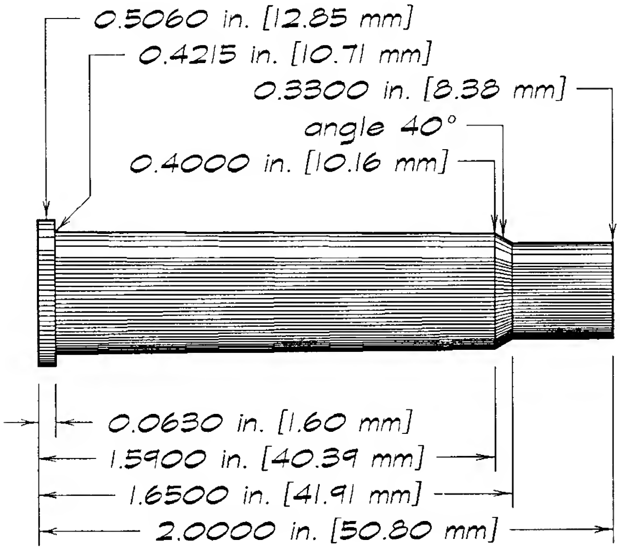
.308 bullet displaces
18.84 grains per inch.

Fire-form .284 Winchester brass with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.30-30 Ackley Improved (David J LeGate)

solid:
538 gr brass
63 gr water

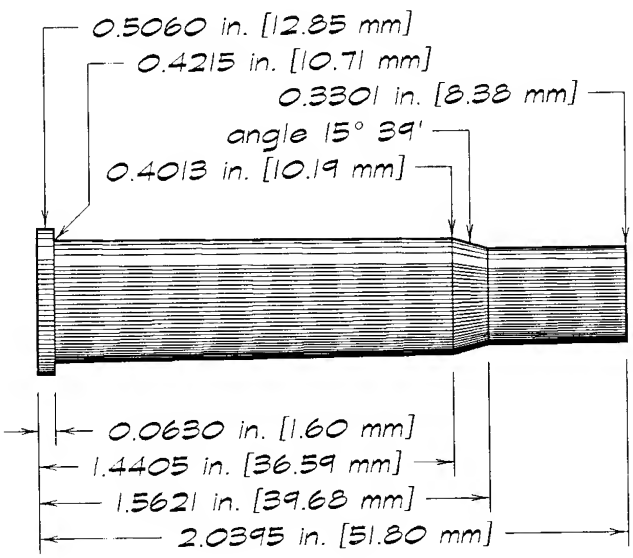


.308 bullet displaces
18.84 grains per inch.

Fire-form .30-30 Winchester brass with inert filler. Or fire .30-30 Winchester ammunition in .30-30 Improved chamber.

.30-30 Winchester (SAAMI maximums)

solid:
530 gr brass
62 gr water



.308 bullet displaces
18.84 grains per inch.

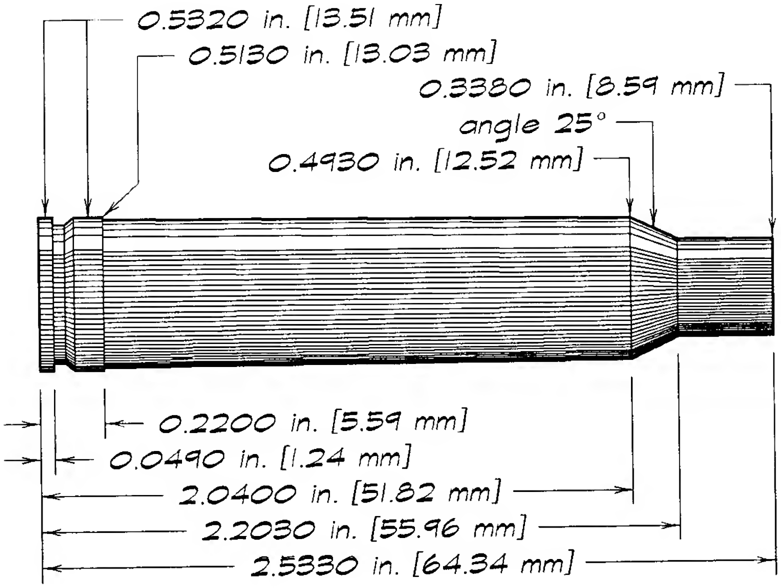
Use factory .30-30 brass. Or form from .32 Winchester Special brass, in RCBS form dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.30-.338 Winchester Magnum

(RCBS drawing)

solid:
1,014 gr brass
119 gr water



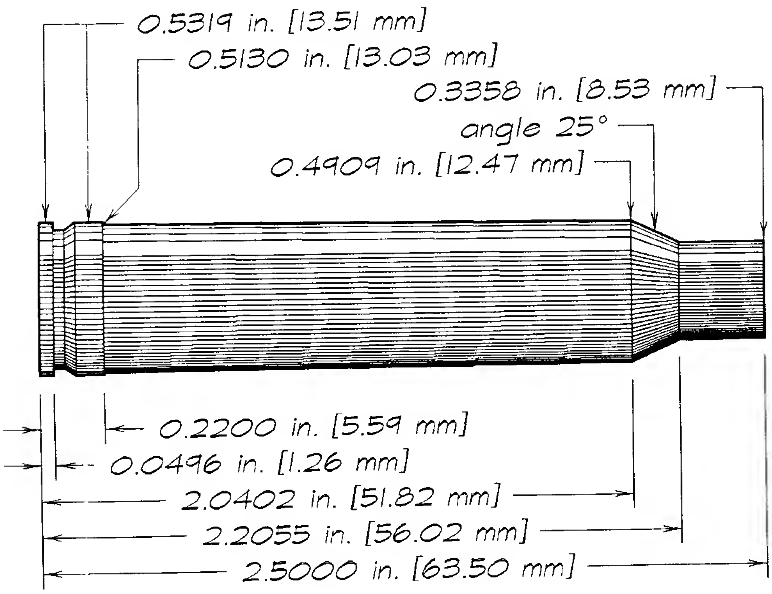
.308 bullet displaces 18.84 grains per inch.

Form from .338 Winchester Magnum, .300 H&H Magnum, or .300 Winchester Magnum in respective RCBS form die.

.30-.338 Magnum

(Triebel maximums)

solid:
1,007 gr brass
118 gr water



.308 bullet displaces 18.84 grains per inch.

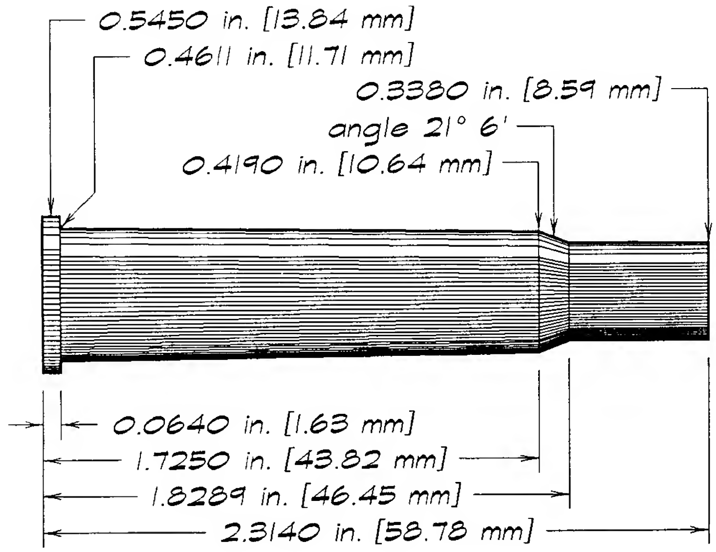
Form from .338 Winchester Magnum, .300 H&H Magnum, or .300 Winchester Magnum in respective RCBS form die.

Anneal only by method shown in text. **Text explains use of "solid" and displacement figures.**

.30-40 Krag

(SAAMI maximums)

solid:
691 gr brass
81 gr water



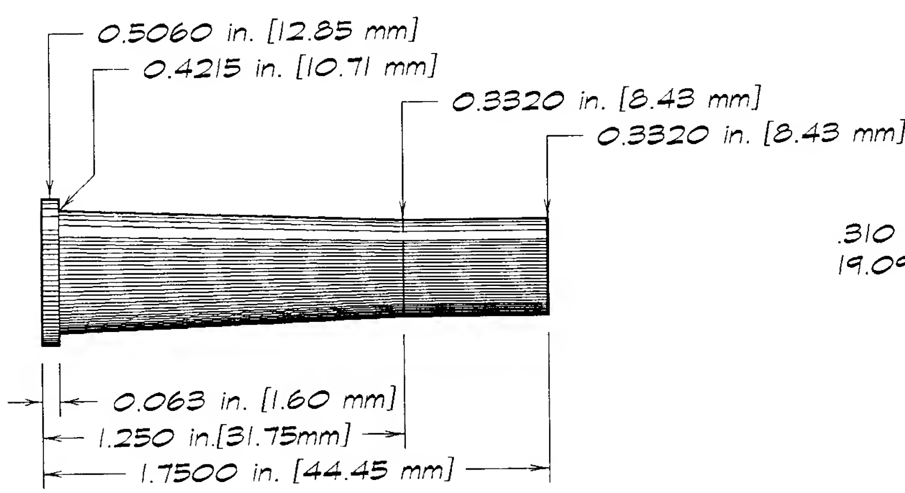
.308 bullet displaces
18.84 grains per inch.

Use recently manufactured .30-40 Krag factory brass. Or form from .303 British brass, in RCBS form die.

.30-78 Single-Shot

(David J LeGate)

solid:
392 gr brass
46 gr water



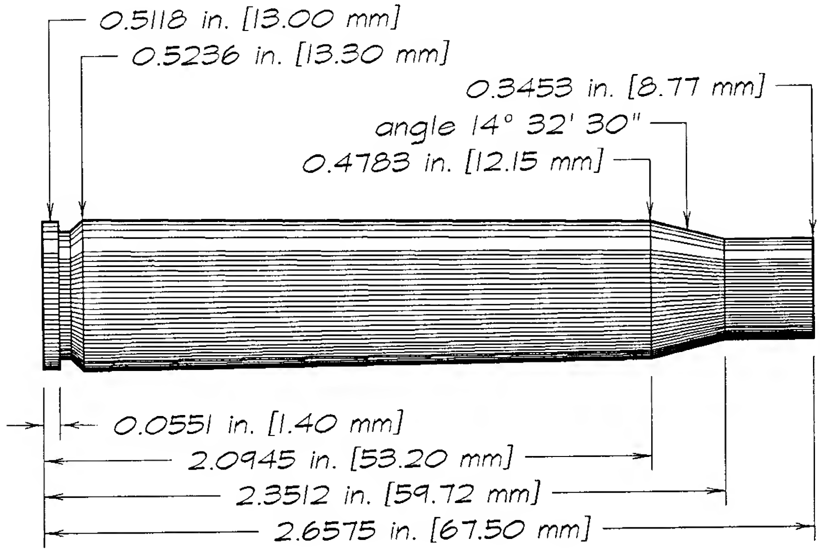
.310 bullet displaces
19.09 grains per inch.

Anneal neck, shoulder, and upper body of .30-30 Winchester brass. Resize full-length in .30-78 sizer die. Trim to length and deburr.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.30-8x68mm (Triebel maximums)

solid:
1,034 gr brass
121 gr water

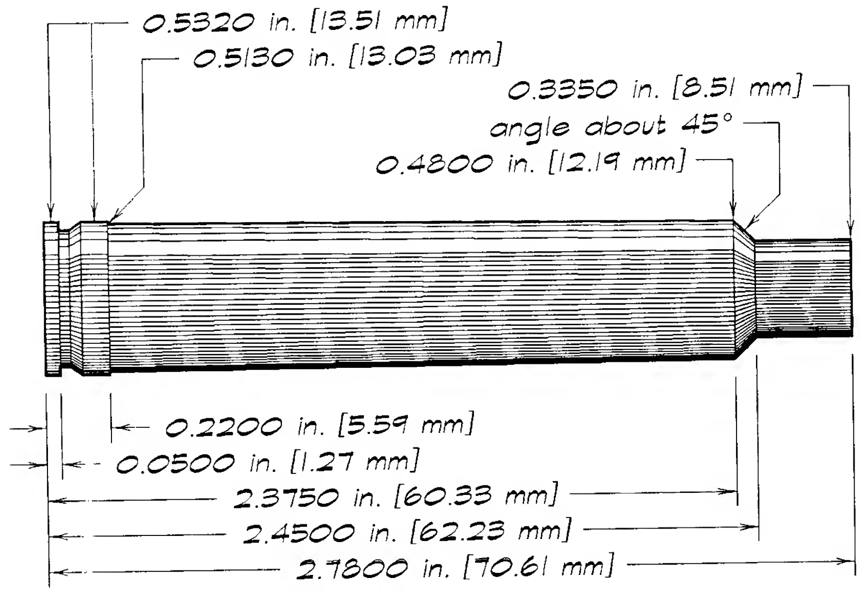


.308 bullet displaces
18.84 grains per inch.

Resize 8x68mm brass full-length in .30-8x68mm sizer die.

.300 AMU (Advanced Marksmanship Unit, U S Army) (specimen rounds)

solid:
1,124 gr brass
132 gr water



.308 bullet displaces
18.84 grains per inch.

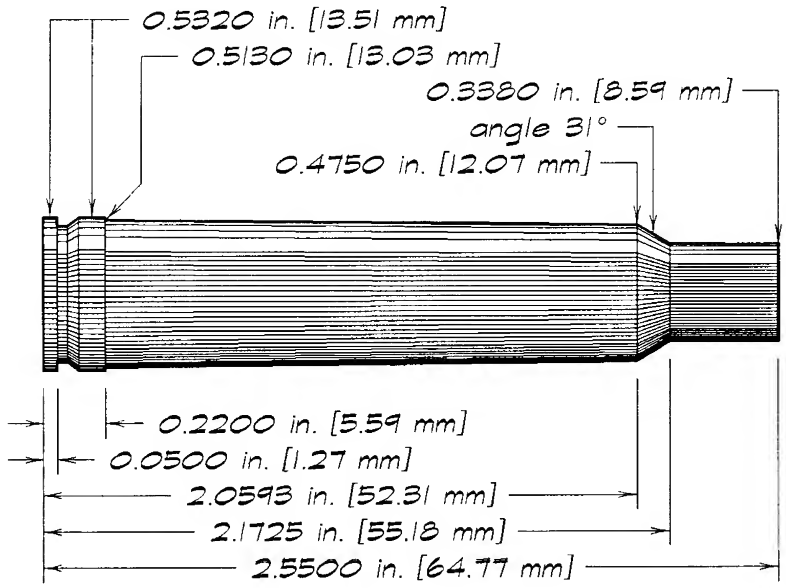
Use factory .300 AMU brass. Or anneal neck and shoulder of .300 H&H Magnum brass, trim to 2.78 inches, deburr, and fire-form with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.300 Apex

(F K Elliott drawing)

solid:
922 gr brass
108 gr water



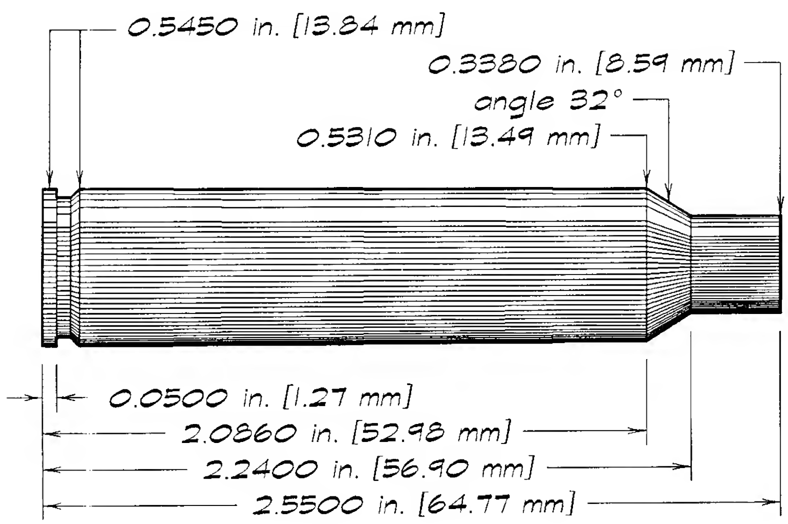
.308 bullet displaces
18.84 grains per inch.

Resize .300 Winchester Magnum brass full-length in .300 Apex sizer die. Trim to 2.55 inches. Deburr.

.300 Dakota

(Dakota Arms drawing)

solid:
1,120 gr brass
131 gr water



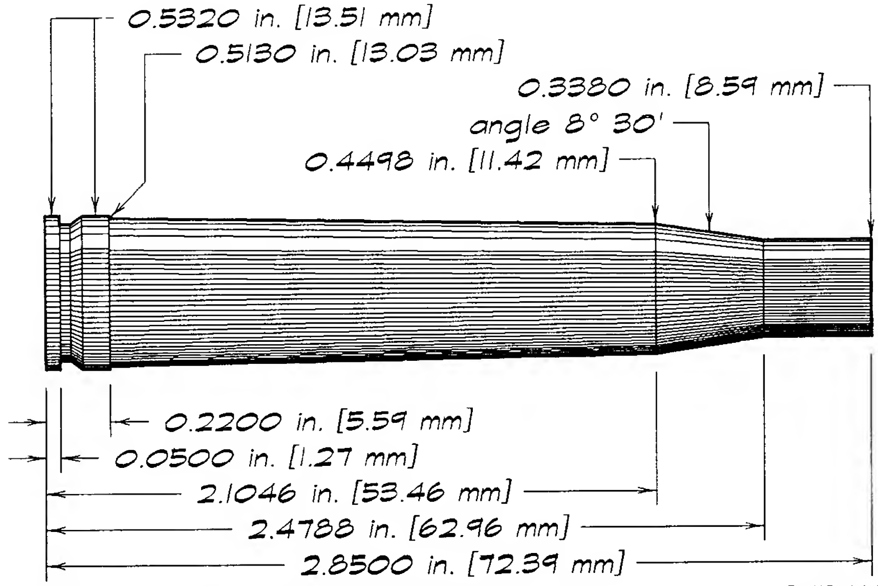
.308 bullet displaces
18..84 grains per inch.

Anneal neck and shoulder of .404 Jeffery brass. Trim to 2.6 inches. Size full-length in .300 Dakota sizing die. Ream inside neck if necessary. Trim to length and deburr mouth.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.300 H&H Magnum (SAAMI maximums)

solid:
1,038 gr brass
122 gr water

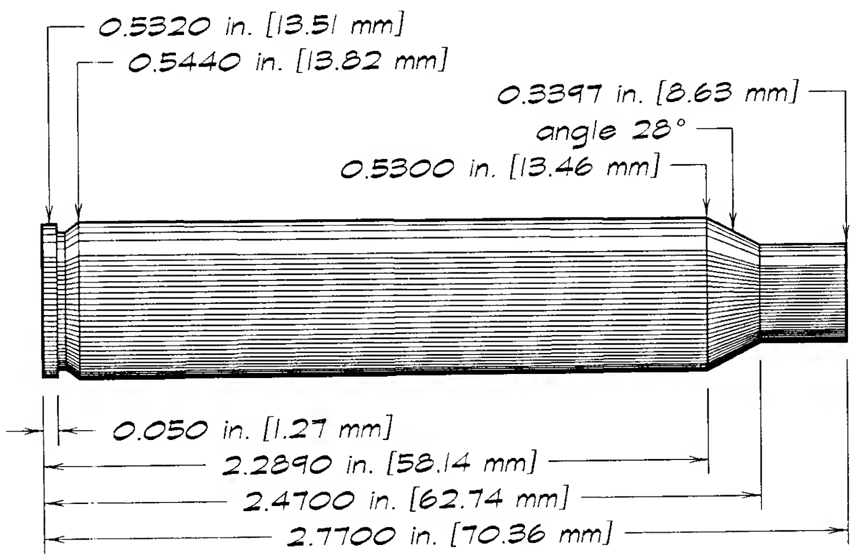


.308 bullet displaces 18.84 grains per inch.

Use factory .300 H&H Magnum brass. Or form from .375 H&H Magnum brass, in RCBS form dies.

.300 Imperial Magnum (Imperial drawing)

solid:
1,221 gr brass
143 gr water



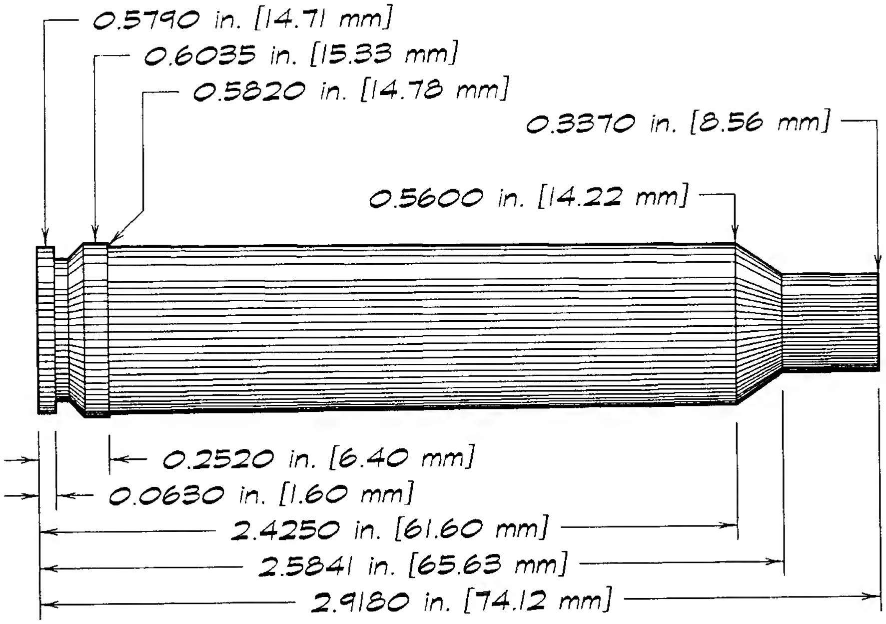
.308 bullet displaces 18.84 grains per inch.

Use .300 Imperial Magnum brass. Or anneal neck and shoulder area of .404 Jeffery Basic brass and form in RCBS form and trim dies. Ream inside neck, in RCBS neck-ream die. Deburr.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.300 Kong

(Layne Simpson specimen)



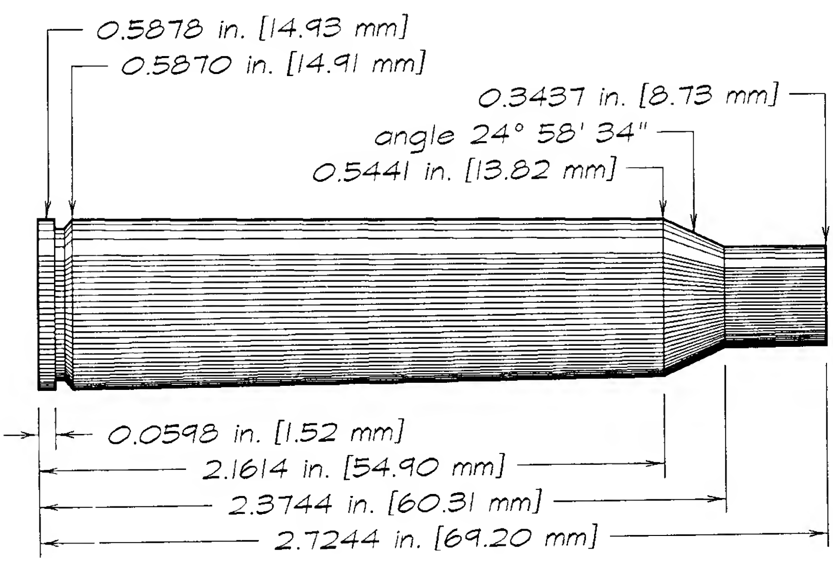
solid:
1,492 gr brass
175 gr water

.308 bullet displaces 18.84 grains per inch.

Form from .378 Weatherby brass, in RCBS form dies.

.300 Lapua Magnum (Finland)

(CIP maximums)



solid:
1,326 gr brass
156 gr water

.308 bullet displaces 18.84 grains per inch.

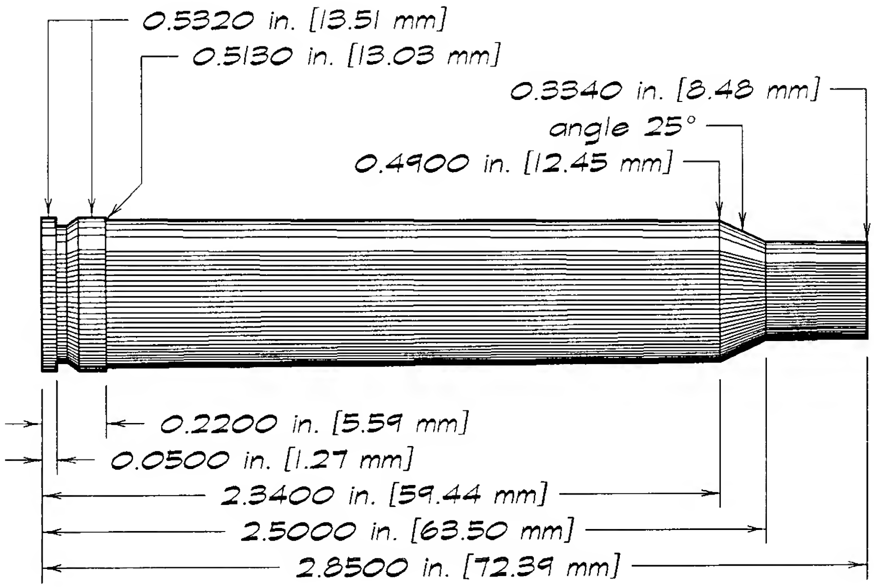
Use .300 Lapua Magnum brass. Or anneal neck and shoulder of .416 Rigby brass and form in RCBS form, trim, and neck-ream dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.300 Mashburn Imperial (Canadian)

(fired specimen)

solid:
1,148 gr brass
135 gr water



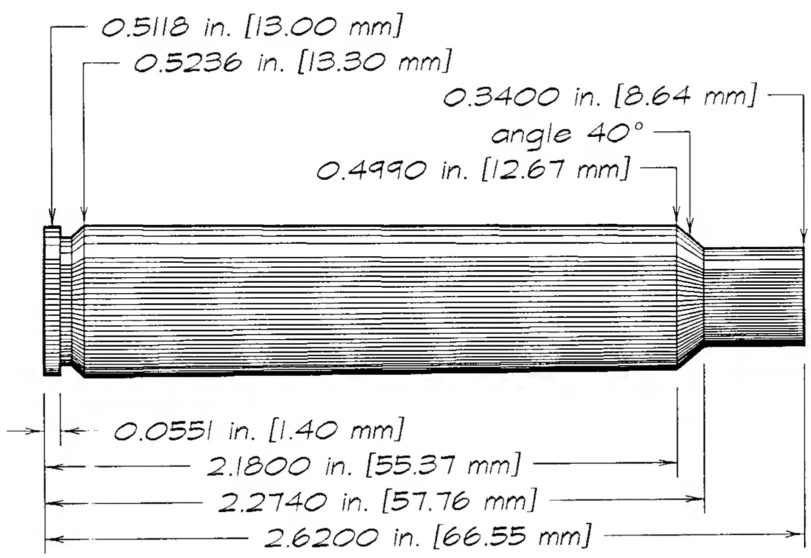
.308 bullet displaces 18.84 grains per inch.

Fire-form .300 H&H or Weatherby Magnum brass with inert filler.

.300 OAM (Norway)

(Ole A Molvaer drawing)

solid:
967 gr brass
113 gr water

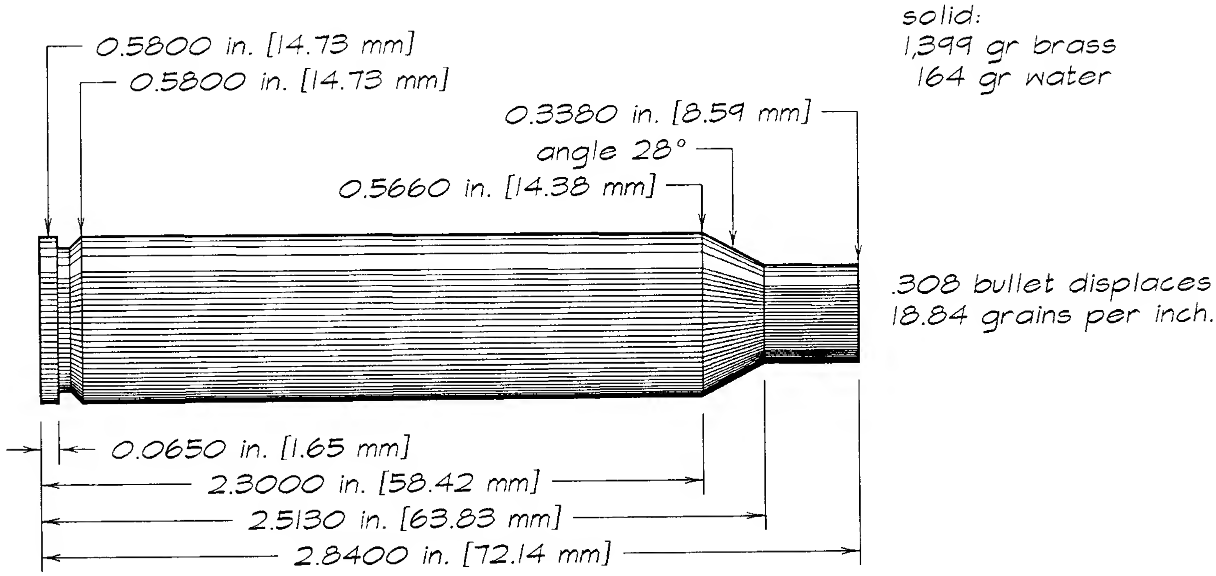


.308 bullet displaces 18.84 grains per inch.

Resize 8x68mm S brass full-length in body of .300 OAM sizer die. Trim to 2.62 inches, fire-form with inert filler, ream inside neck, and deburr.

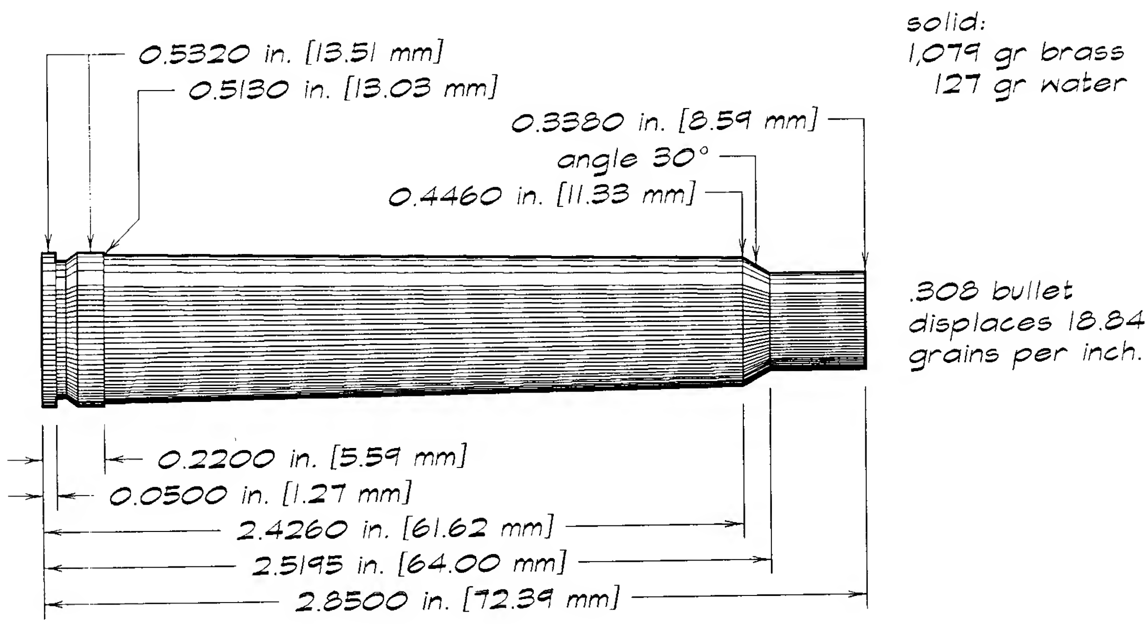
Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.300 Petersen (A-Square maximums)



Use A-Square or A-Cube .300 Petersen brass.

.300 Pfeifer Magnum (F K Elliott drawing)



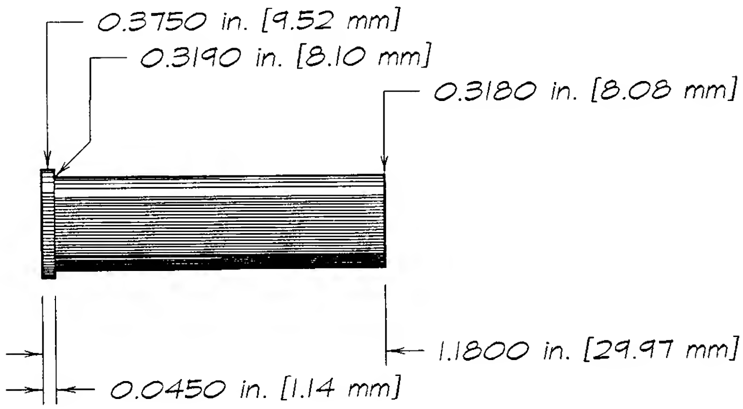
Fire-form .300 H&H Magnum brass with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.300 Rook Rifle

(ICI Metals Ltd dwg)

solid:
199 gr brass
23 gr water



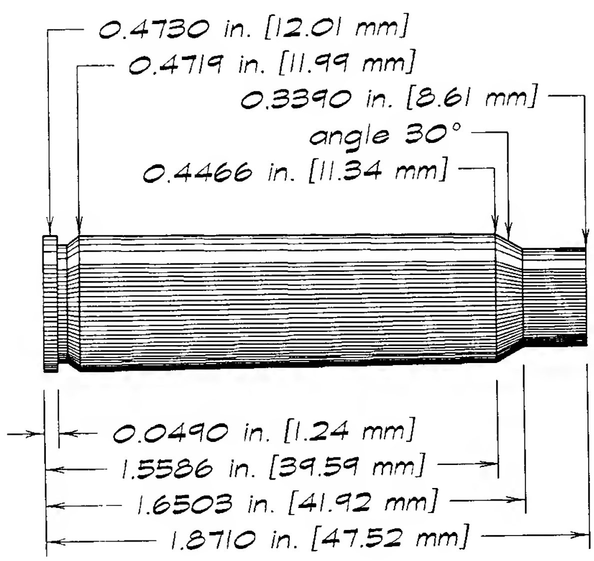
.301 bullet displaces
17.99 grains per inch.

Use factory .300 Rook brass.

.300 Savage

(SAAMI maximums)

solid:
628 gr brass
74 gr water



.308 bullet displaces
18.84 grains per inch.

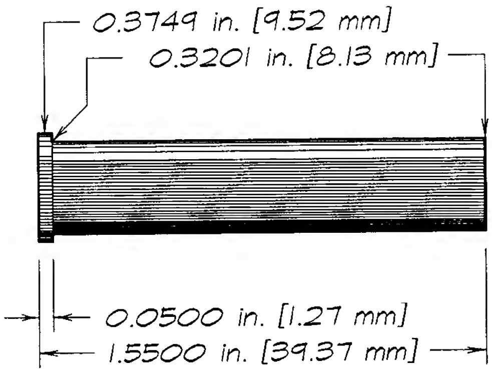
Use factory .300 Savage brass. Or form from .308 Winchester or .30-06 Springfield brass, in respective RCBS form dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.300 Sherwood

(CIP maximums)

solid:
267 gr brass
31 gr water



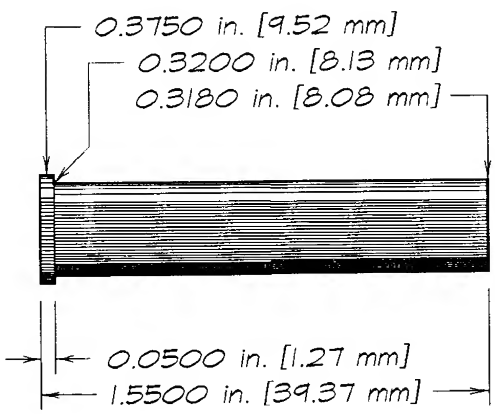
.300 bullet displaces
17.88 grains per inch.

Use recently manufactured .300 Sherwood brass.

.300 Sherwood

(ICI Metals Ltd dwg)

264 gr brass
31 gr water

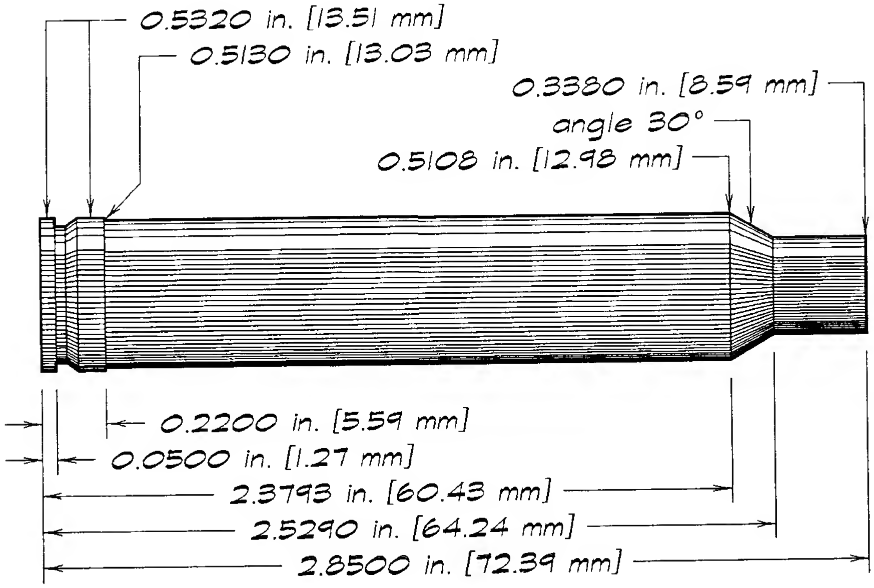


.300 bullet displaces
17.88 grains per inch.

Use recently manufactured .300 Sherwood brass.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.300 Tietz-Novotny Thunderbolt (Tietz's specifications)

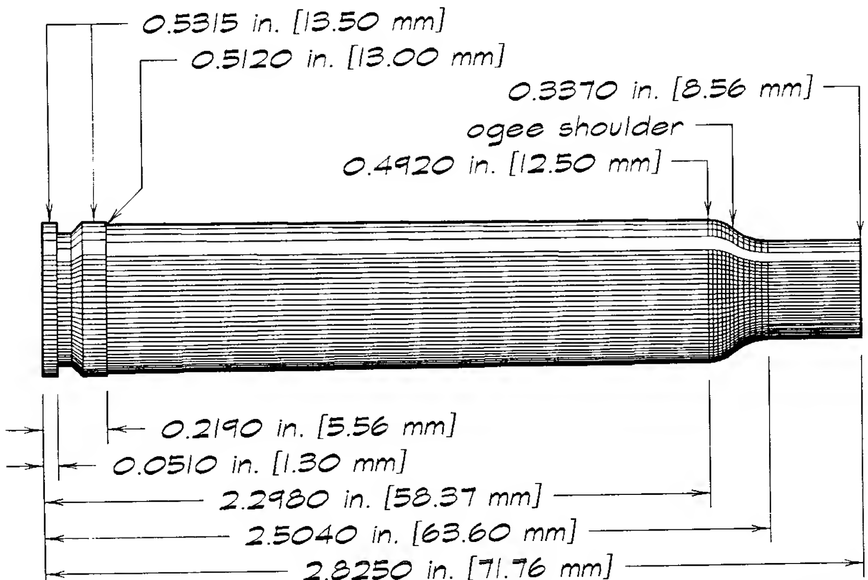


solid:
1,172 gr brass
137 gr water

.308 bullet displaces 18.84 grains per inch.

Fire .300 H&H Magnum or .300 Weatherby Magnum ammunition in .300 TNT rifle. Or fire-form .300 H&H or Weatherby Magnum brass with inert filler.

.300 Weatherby Magnum (SAAMI maximums)



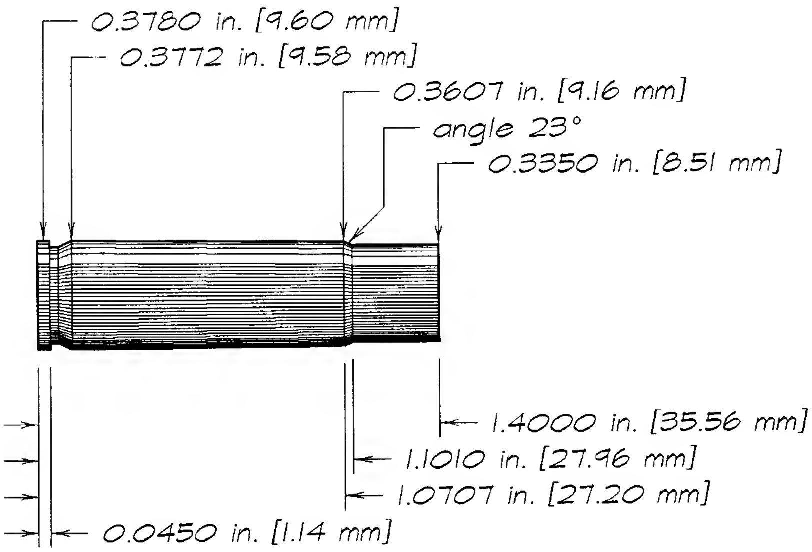
solid:
1,131 gr brass
133 gr water

.308 bullet displaces 18.84 grains per inch.

Use factory .300 Weatherby Magnum brass. Or trim .300 H&H Magnum brass to 2.82 inches and fire-form with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.300 Whisper (unidentified drawing)

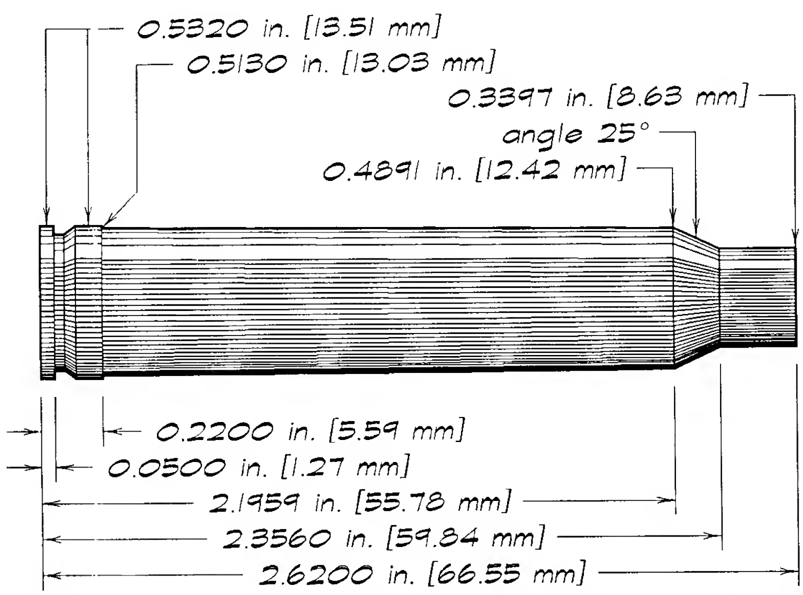


solid:
313 gr brass
37 gr water

.308 bullet displaces
18.84 grains per inch.

Anneal neck and shoulder of .221 Fireball, .222 Remington, or .223 Remington brass. Fire-form with inert filler. Trim .222 or .223 brass. Deburr.

.300 Winchester Magnum (SAAMI maximums)



solid:
985 gr brass
116 gr water

.308 bullet displaces
18.84 grains per inch.

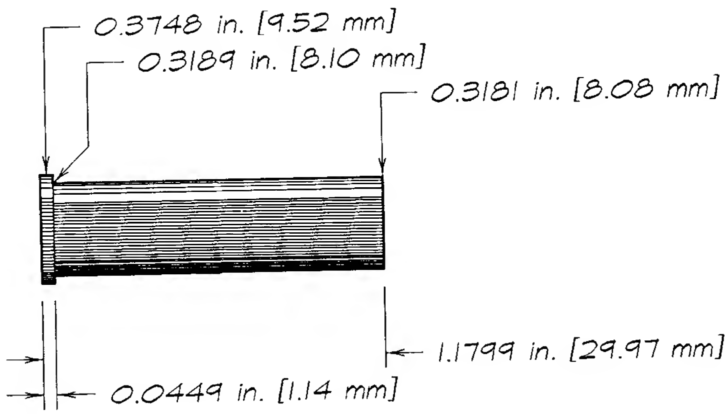
Use factory .300 Winchester Magnum brass. Or form from .300 H&H Magnum brass, in RCBS form die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.300-.295 Rook Rifle

(CIP maximums)

solid:
199 gr brass
23 gr water



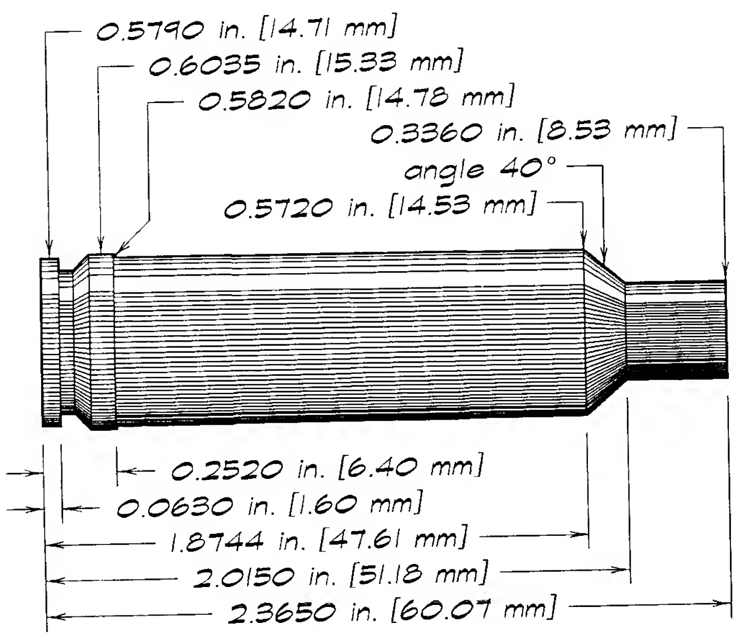
.301 bullet displaces
17.99 grains per inch.

Use recently manufactured .300-.295 Rook Rifle brass.

.300x60 MGL Max Mag

(designer's specs)

solid:
1,187 gr brass
139 gr water

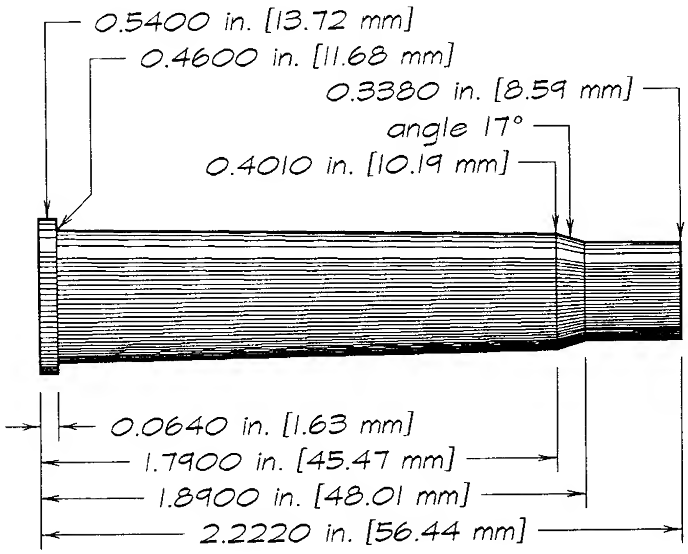


.308 bullet displaces
18.84 grains per inch

Anneal neck, shoulder, and upper body of .378 Weatherby Magnum brass. Form and trim in RCBS form and trim dies. Ream inside neck, in RCBS neck-ream die. Deburr mouth. Fire-form with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.303 British (Birmingham Proof House)

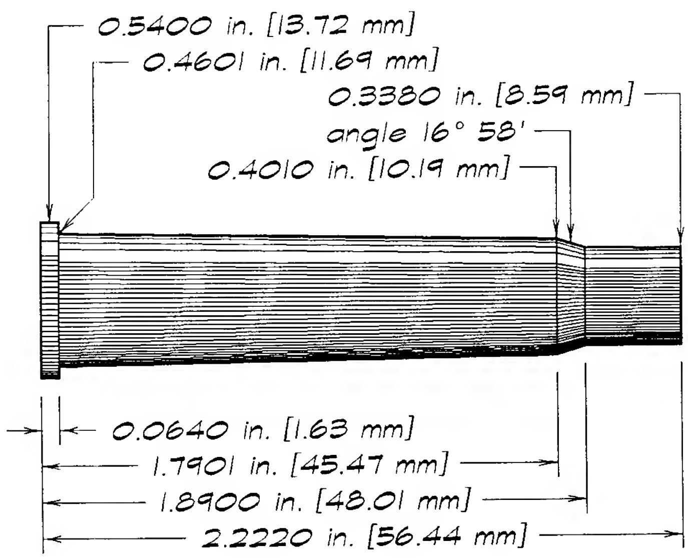


solid:
663 gr brass
78 gr water

.312 bullet displaces
19.33 grains per inch.

Use factory .303 British brass. Or resize .30-40 Krag brass full-length in body (with decapper-expander assembly removed) of .303 British sizer die.

.303 British (SAAMI maximums)



solid:
663 gr brass
78 gr water

.312 bullet displaces
19.33 grains per inch.

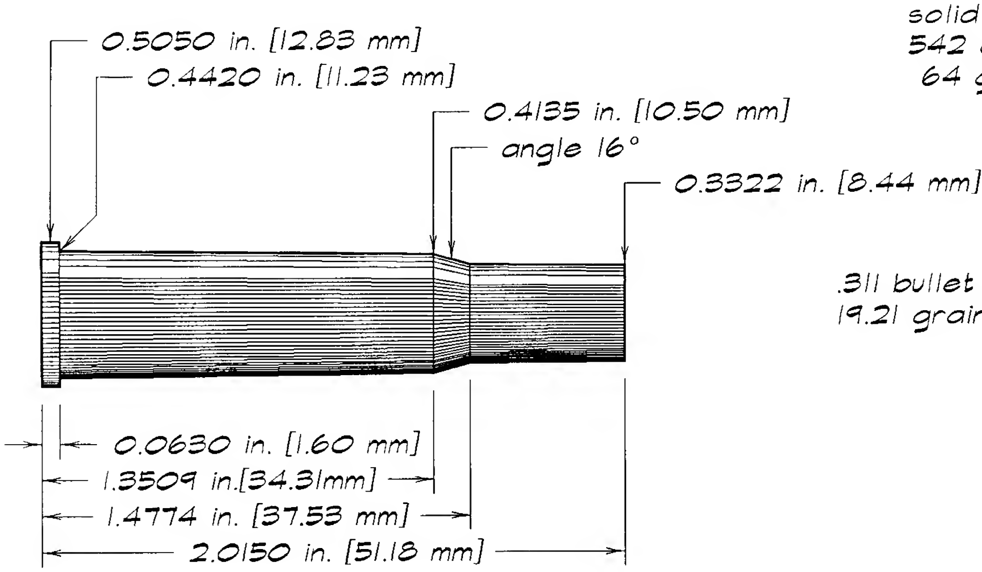
Use Boxer-primed .303 British cases. Or resize .30-40 Krag brass full-length in body (with expander assembly removed) of .303 British sizer die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.303 Savage

(SAAMI maximums)

solid:
542 gr brass
64 gr water



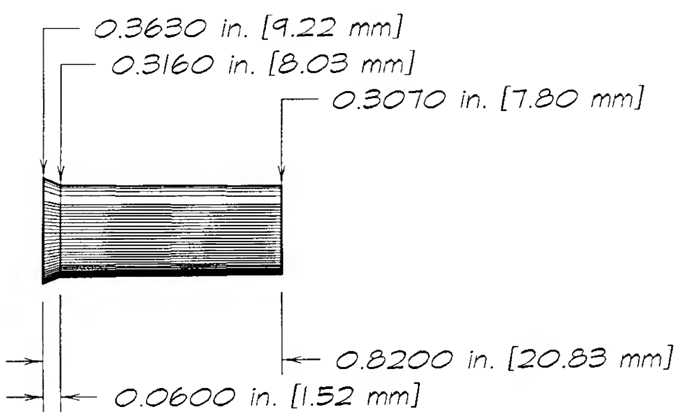
.311 bullet displaces
19.21 grains per inch.

Use factory .303 Savage brass. Or fire-form .220 Swift brass with inert filler, then back .303 Savage sizer die off to headspace the derived case on the shoulder instead of the rim. Trim to length and deburr mouth.

.303 Wilkinson Practice Adapter (insert cartridge)

(specimen round)

solid:
138 gr brass
16 gr water



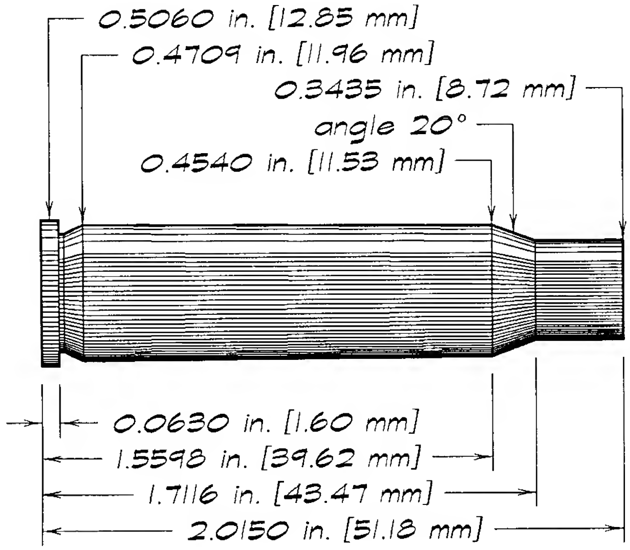
heeled bullet

Chamfer forward edge of rim of .32 Long Colt brass and trim to 0.82 inch.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.307 Winchester

(SAAMI maximums)



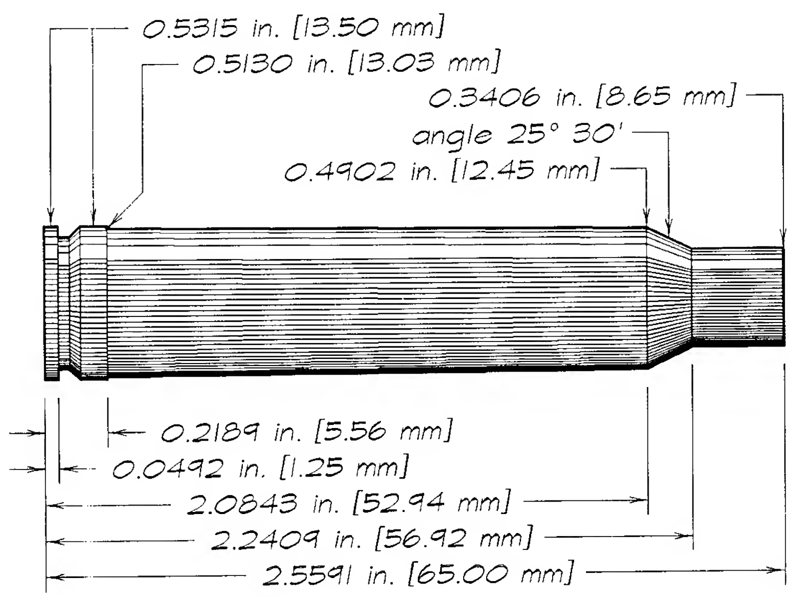
solid:
694 gr brass
81 gr water

.308 bullet displaces
18.84 grains per inch.

Use factory .307 Winchester brass. Or, if extractor can handle it, use .308 Winchester brass (NOT .308 WINCHESTER AMMO) and adjust sizer die to make sure each case headspaces on the shoulder.

.308 Norma Magnum

(CIP maximums)



solid:
1,024 gr brass
120 gr water

.309 bullet displaces
18.96 grains per inch.

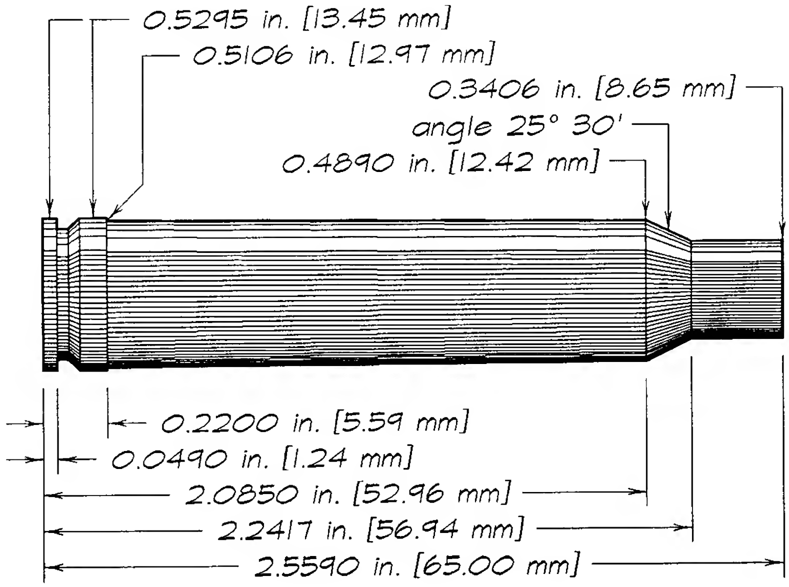
Use .308 Norma Magnum brass. Or anneal shoulder and upper body of .300 Winchester Magnum brass, trim to 2.56 inches, and resize full-length in .308 Morma Magnum sizer die. Trim to 2.55 inches and deburr. Ream necks if necessary.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.308 Norma Magnum

(Norma drawing)

solid:
1,017 gr brass
119 gr water



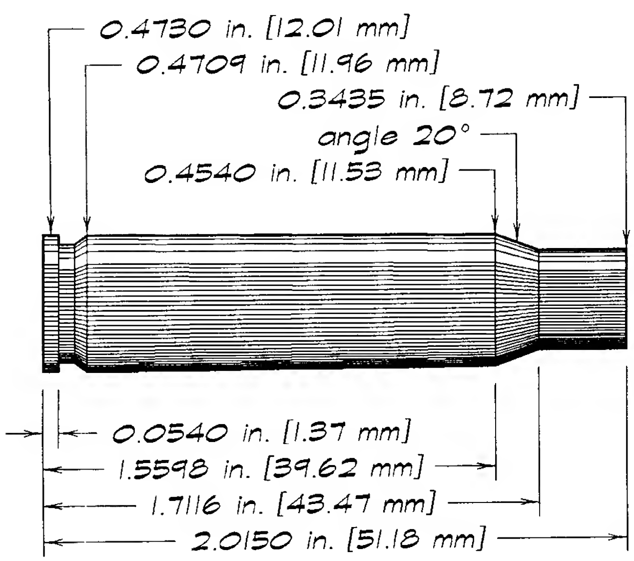
.308 bullet displaces
18.84 grains per inch.

Use .308 Norma Magnum brass. Or anneal shoulder and upper body of .300 Winchester Magnum brass, trim to 2.56 inches, and resize full-length in .308 Norma Magnum sizer die. Trim to 2.55 inches and deburr. Ream necks if necessary.

.308 Winchester

(SAAMI maximums)

solid:
665 gr brass
78 gr water

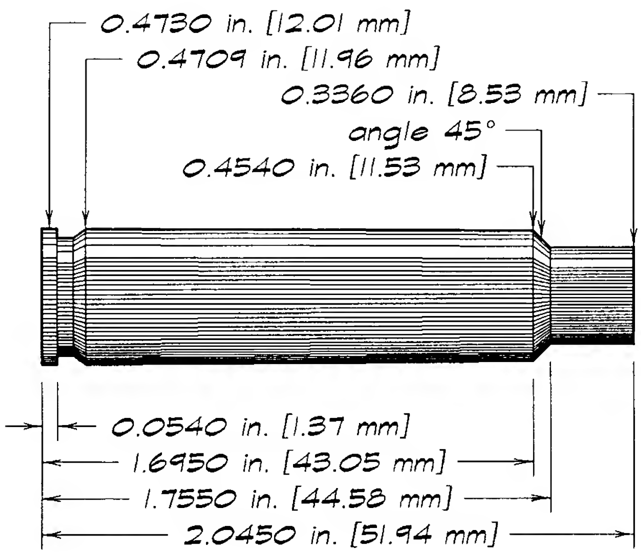


.308 bullet displaces
18.84 grains per inch.

Use factory .308 Winchester brass (military or commercial). Or form from any .30-06-based case that's long enough (.25-06, 7x57mm, .270, .280, .30-06, .35 Whelen, 8x57mm Mauser). Anneal neck and shoulder; trim to 2.1 inches; resize full-length in .308 Winchester sizer die. Ream inside neck if necessary. Trim to length and deburr mouth. NOTE: remove crimp from primer pockets of GI cases.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.308 Winchester Davis Improved (designer's specs)

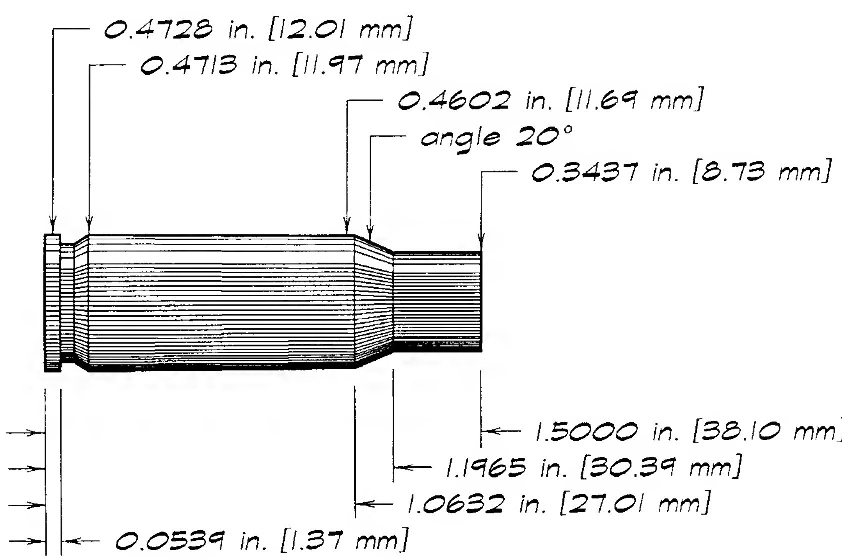


solid:
686 gr brass
80 gr water

.308 bullet displaces
18.84 grains per inch.

Anneal neck, shoulder, and upper body of .308 Winchester brass. Expand neck with 8mm expander, then resize neck in .308 Davis Improved sizer die. Fire-form with inert filler.

.308 1½-Inch (Triebel maximums)



solid:
485 gr brass
57 gr water

.308 bullet displaces
18.84 grains per inch.

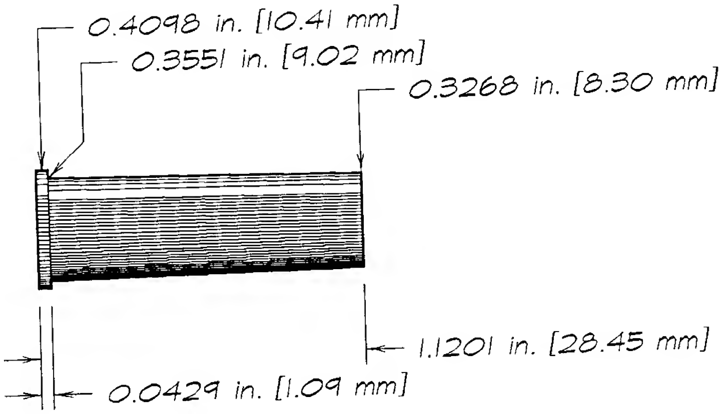
Anneal neck, shoulder, and upper body of .308 Winchester brass. Form in RCBS form and trim dies. Trim. Ream inside neck, in RCBS neck-ream die. Deburr.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.310 Cadet Rifle

(CIP maximums)

solid:
223 gr brass
26 gr water



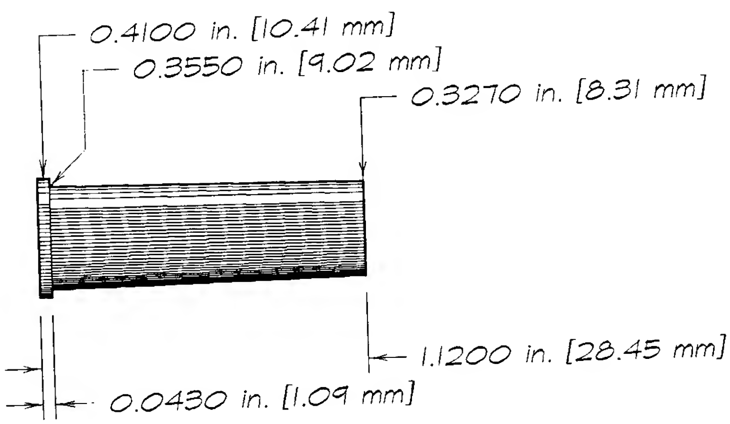
.323 bullet displaces 20.72 grains per inch.
.310 bullet displaces 19.08 grains per inch.
(Bores vary widely -- average .314 bullet displaces 19.58 grains per inch.)

Use factory .310 Cadet brass. Or fire-form .32-20 Winchester brass with inert filler, trim to 1.12 inch long, and deburr. (Slug bore for proper bullet diameter.)

.310 Cadet

(ICI Metals Ltd dwg)

solid:
226 gr brass
26 gr water



.323 bullet displaces 20.72 grains per inch.
.310 bullet displaces 19.09 grains per inch.
.328 bullet displaces 21.37 grains per inch.
Bores vary widely, so slug barrel to determine correct bullet diameter.

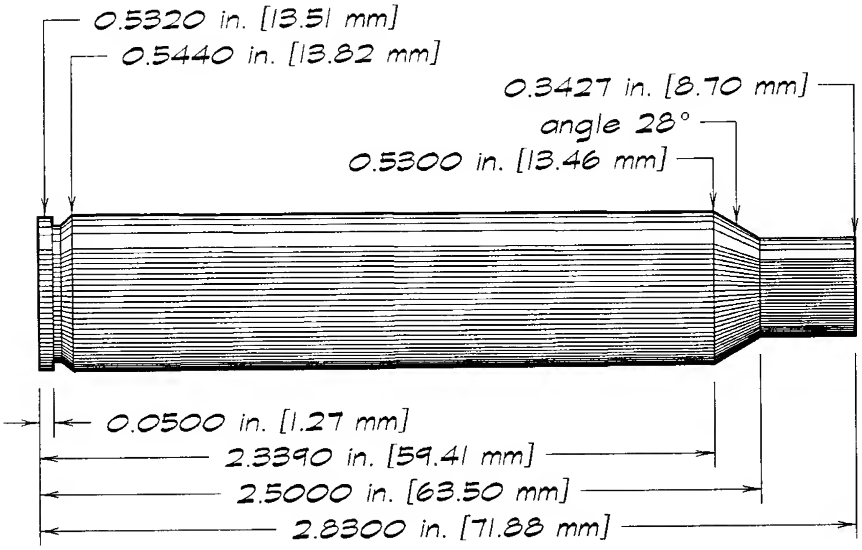
Use .310 Cadet brass. Or fire-form .32-20 Winchester brass with inert filler, trim to 1.12 inch long, and deburr.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.311 Imperial Magnum

(Imperial drawing)

solid:
1,248 gr brass
146 gr water



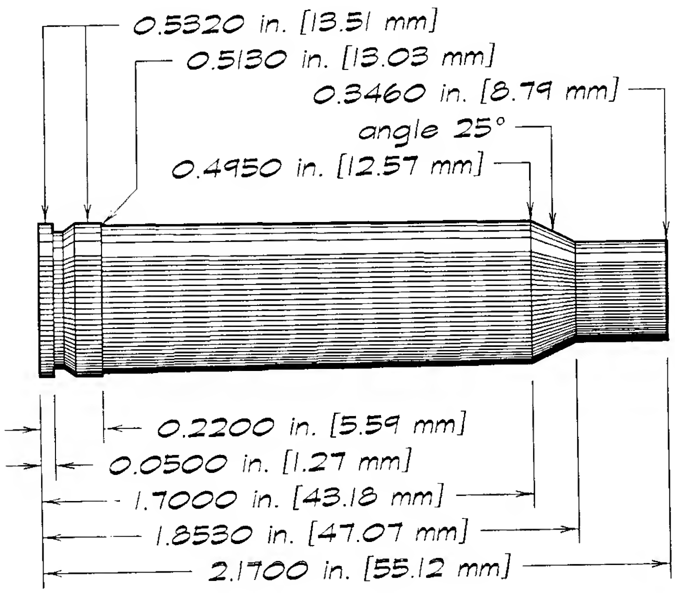
.311 bullet displaces
19.21 grains per inch.

Use .311 Imperial Magnum brass. Or anneal neck and shoulder area of .404 Jeffery Basic brass and form in RCBS form and trim dies. Ream inside neck, in RCBS neck-ream die. Deburr.

.312 Express

(Ken Waters)

solid:
860 gr brass
101 gr water



.312 bullet displaces
19.33 grains per inch.

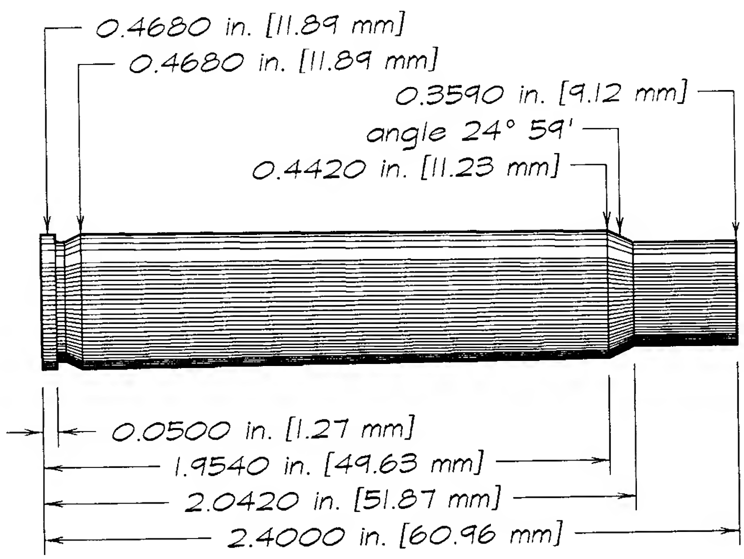
Resize .350 Remington brass full-length in .312 Express sizer die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.318 Nitro Express

(ICI Metals Ltd dwg)

solid:
791 gr brass
93 gr water



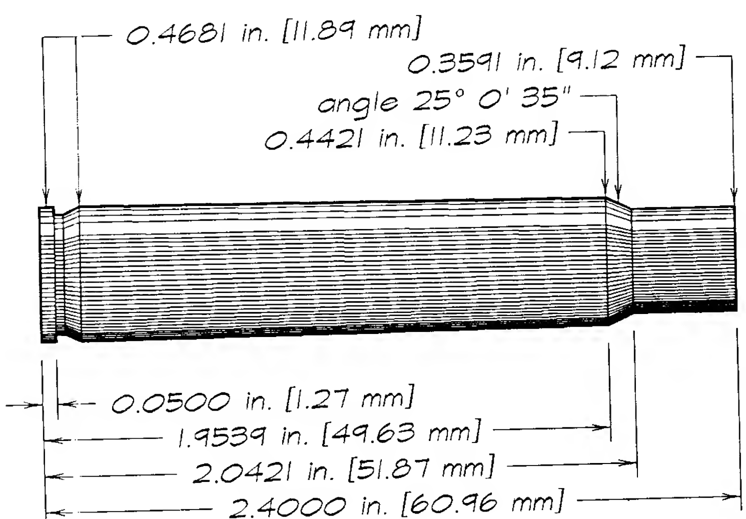
.330 bullet displaces
21.63 grains per inch.

Use factory .318 Rimless brass. Or resize .35 Whelen brass full-length in .318 NE sizer die and fire-form with inert filler. Trim to 2.4 inches and deburr. Or resize .30-06 Springfield brass full-length in body of .318 NE sizer die (with expander-decapper removed), fire-form with inert filler, trim to 2.4 inches and deburr.

.318 Rimless Nitro Express

(CIP maximums)

solid:
791 gr brass
93 gr water



.330 bullet displaces
21.63 grains per inch.

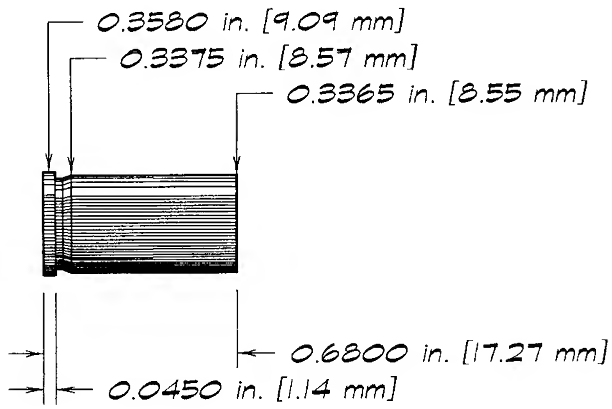
Use factory .318 Rimless NE brass. Or resize .35 Whelen brass full-length in .318 Rimless NE sizer die, fire-form with inert filler, trim to 2.4 inches, and deburr. Or resize .30-06 Springfield brass full-length in body of .318 sizer die (without decapper-expander punch). Fire-form with inert filler. Trim to 2.4 inches. Deburr.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.32 Automatic (.32 ACP)

(SAAMI maximums)

solid:
135 gr brass
16 gr water



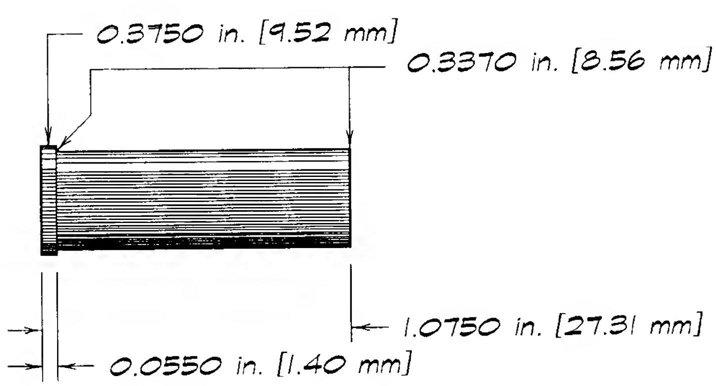
.312 bullet displaces
19.33 grains per inch.

Use factory .32 Auto (or .32 ACP) brass. Or turn head of .32 S&W Short or .32 S&W Long to .32 Auto dimensions and trim case to length.

.32 H&R Magnum

(SAAMI maximums)

solid:
225 gr brass
26 gr water



.315 bullet displaces
19.70 grains per inch.

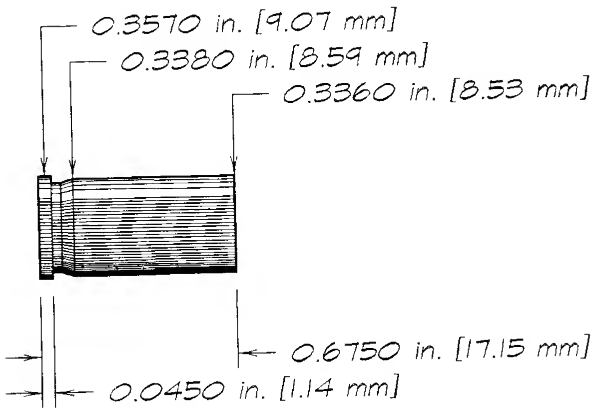
Use factory .32 H&R Magnum brass.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.32 Kynoch Automatic (7.65mm Browning)

(ICI Metals Ltd dwg)

solid:
133 gr brass
16 gr water



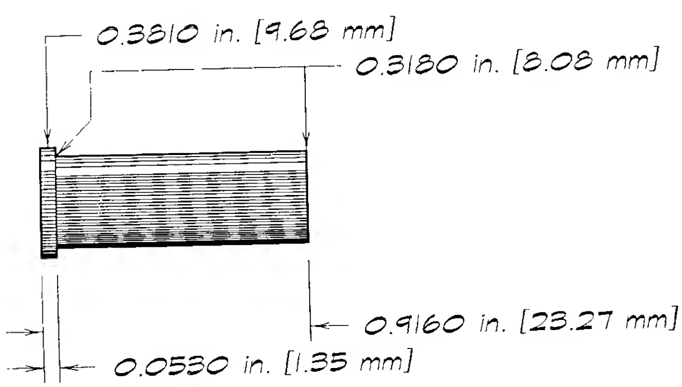
.308 bullet displaces
18.84 grains per inch.

Use factory brass (.32 Kynoch Auto, 7.65mm Browning, .32 Automatic, .32 ACP).

.32 Long Colt

(SAAMI maximums)

solid:
156 gr brass
18 gr water



special heeled bullet

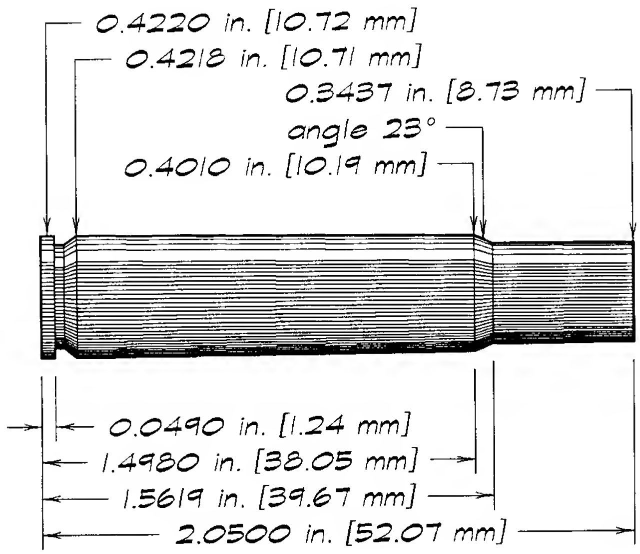
Use factory .32 Long Colt brass. There's no satisfactory substitute.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.32 Remington

(SAAMI maximums)

solid:
543 gr brass
64 gr water



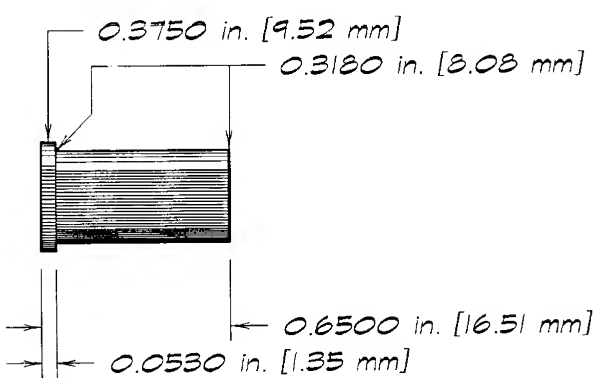
.321 bullet displaces 20.47 grains per inch.

Use factory .32 Remington brass. Or fire-form .30 Remington brass with inert filler. If desperate, lathe-turn head of .30-30 Winchester to .32 Remington head dimensions and fire-form with inert filler.

.32 Short Colt

(SAAMI maximums)

solid:
111 gr brass
13 gr water



special heeled bullet

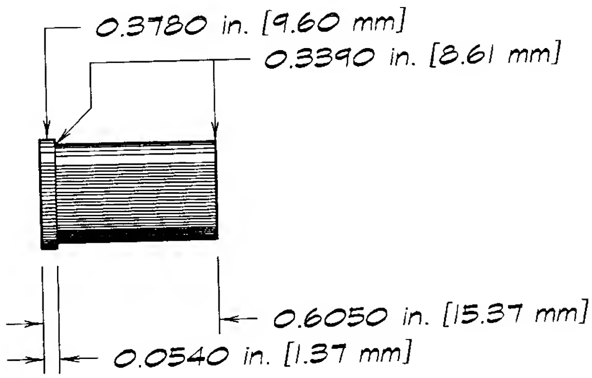
Use factory .32 Short Colt brass. Or trim .32 Long Colt brass to 0.650 inch and deburr mouth.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.32 Smith & Wesson (.32 S&W)

(SAAMI maximums)

solid:
129 gr brass
15 gr water



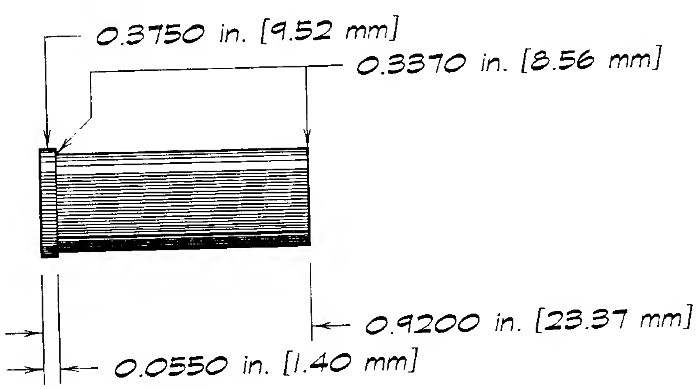
.315 bullet displaces
19.71 grains per inch.

Use factory .32 S&W brass. Or trim .32 S&W Long (.32 Colt NP) brass to 0.605 inch long and deburr mouths.

.32 Smith & Wesson Long (.32 Colt New Police)

(SAAMI maximums)

solid:
193 gr brass
23 gr water



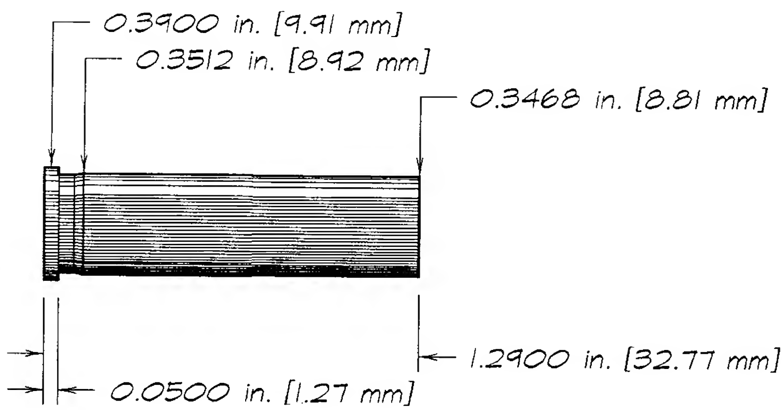
.315 bullet displaces
19.71 grains per inch.

Use factory .32 S&W Long (.32 Colt NP) brass. No satisfactory substitute is available. .32 S&W brass is appropriate for reduced loads (.32 S&W loads, in other words).

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.32 Winchester Self-Loading (SAAMI maximums, 1965)

solid:
288 gr brass
34 gr water

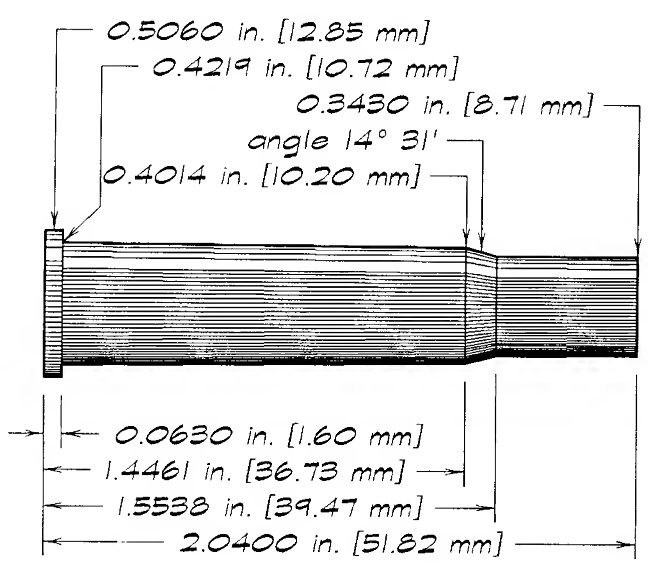


.322 bullet displaces
20.59 grains per inch.

Use recently manufactured .32 WSL brass.

.32 Winchester Special (SAAMI maximums)

solid:
535 gr brass
63 gr water



.322 bullet displaces
20.59 grains per inch.

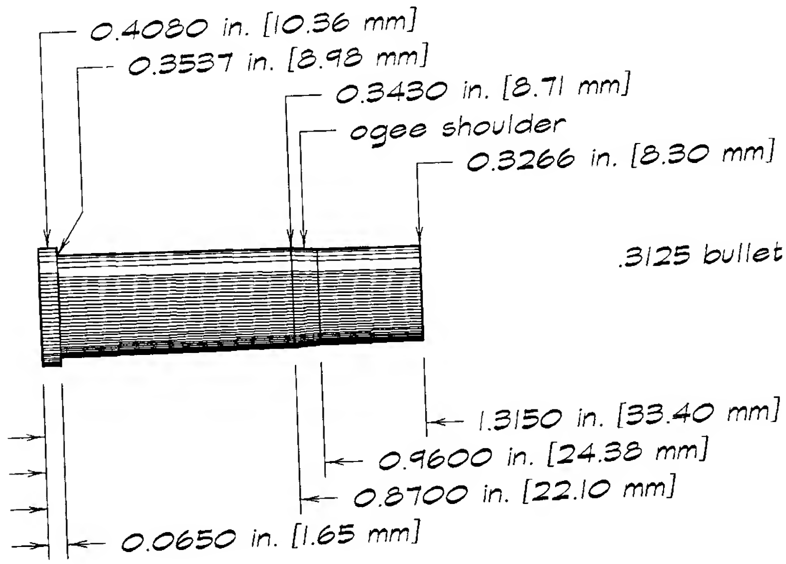
Use factory .32 Special brass. Or resize .30-30 Winchester brass full-length in .32 Special sizer die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

(Winchester drawing, 1911)

.32-20 Marlin

solid:
264 gr brass
31 gr water



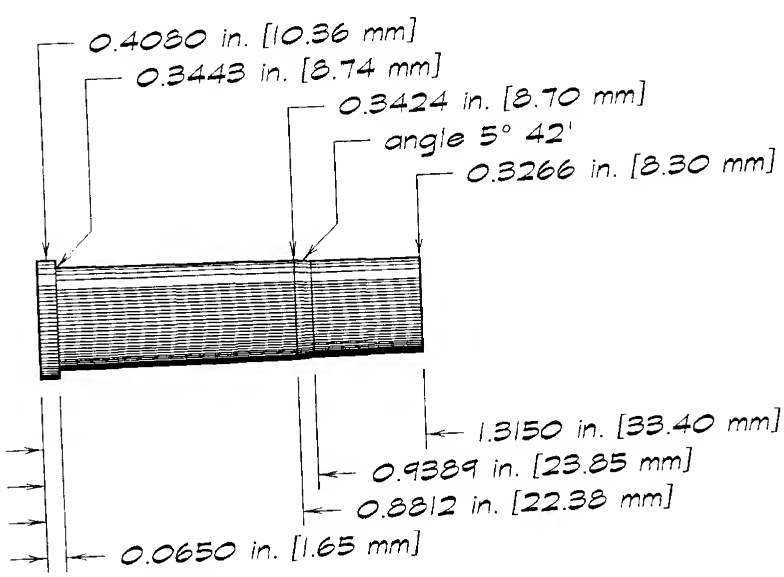
.3125 bullet displaces 19.40 gr/in.

Only slightly different from .32-20 Winchester, close enough to be considered identical. Resize .32-20 Winchester case in .32-20 Marlin die and fire-form in .32-20 Marlin chamber. Back sizing die off enough to let the slight shoulder be the headspace surface, not the rim, to prevent head separations in a loose or springy breech.

(SAAMI maximums)

.32-20 Winchester

solid:
263 gr brass
31 gr water



.312 bullet displaces
19.33 grains per inch.

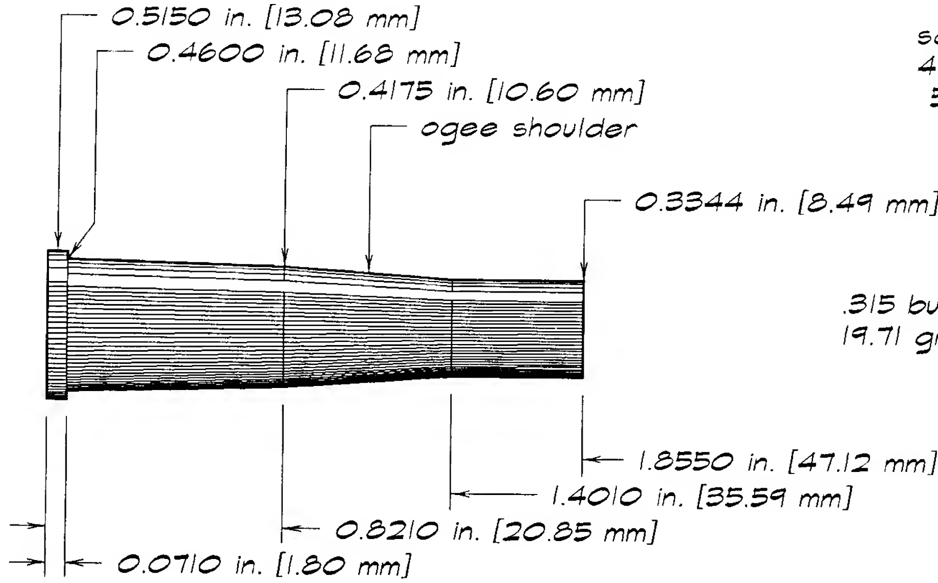
Use recently manufactured .32-20 Winchester brass. Or fire-form .25-20 Winchester brass with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.32-40 Bullard

(Winchester drawing, 1912)

solid:
494 gr brass
58 gr water



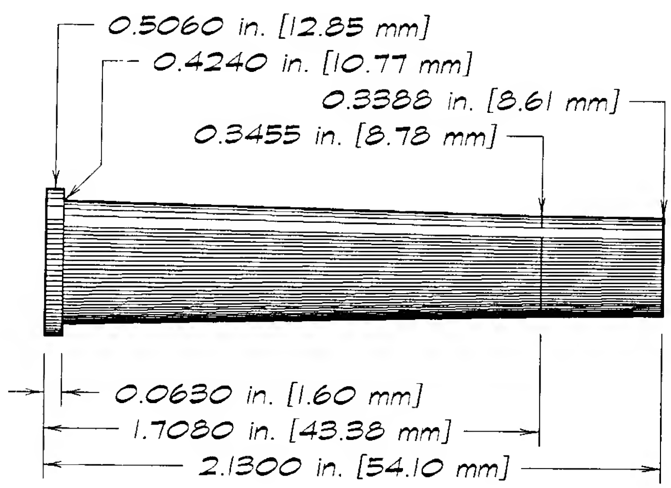
.315 bullet displaces
19.71 grains per inch.

Anneal neck and shoulder of .303 British brass. Form and trim in RCBS form and trim dies. Back the sizing die off to let the Bullard shoulder (not the rim) maintain headspace. The .303 British rim is too thin. Ream inside neck, if necessary, in RCBS neck-ream die. Deburr.

.32-40 Winchester

(SAAMI maximums)

solid:
513 gr brass
60 gr water



.321 bullet displaces
20.47 grains per inch.

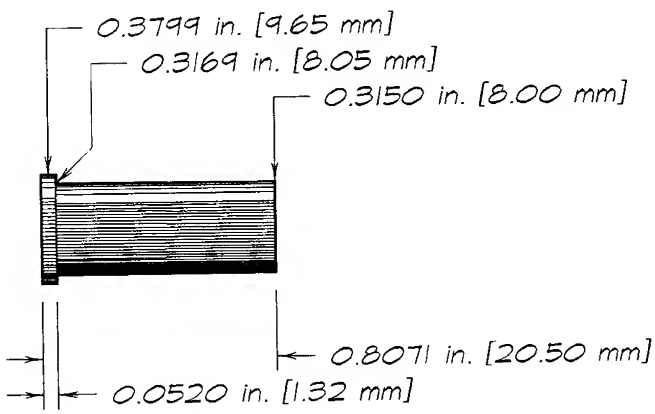
Use recently manufactured .32-40 Winchester brass. Or form from .30-30 Winchester, .32 Winchester Special, or .38-55 Winchester brass, in respective RCBS form die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.320 Long

(CIP maximums)

solid:
137 gr brass
16 gr water



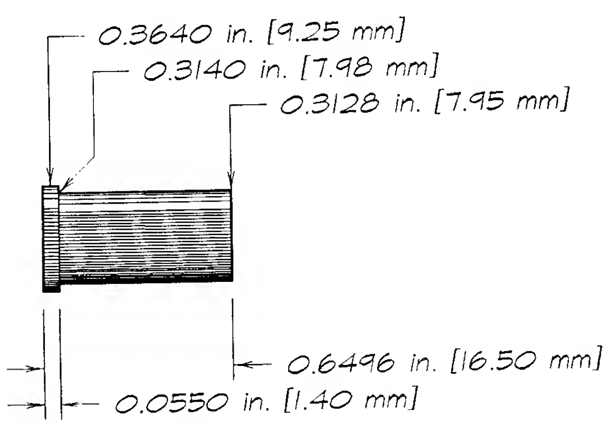
.303 bullet displaces
18.23 grains per inch.

Use factory .320 Long brass. Or trim .32 Colt Long to 0.8 inch long and deburr. Resize full-length in .320 Long sizer die.

.320 Revolver

(Brno drawing, 1940)

solid:
110 gr brass
13 gr water



.315 bullet displaces
19.71 grains per inch.

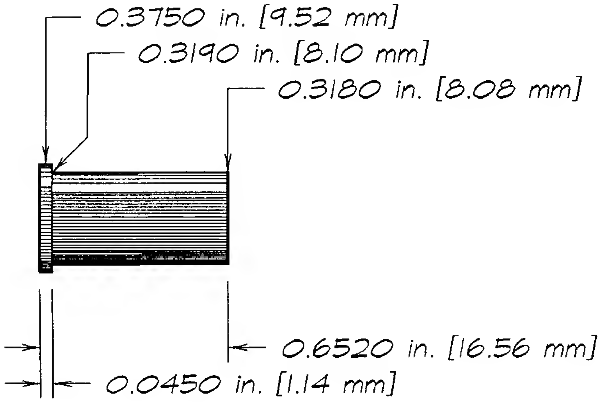
Turn rim of .32 Short Colt to 0.364 inch diameter, resize full-length, and load.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.320 Revolver (British)

(Birmingham Proof House)

solid:
111 gr brass
13 gr water



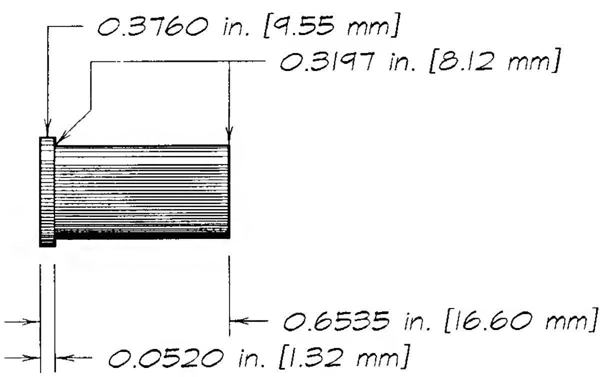
.310 bullet displaces
19.09 grains per inch.

Use the nearly identical .32 Short Colt brass (or trim .32 Long Colt brass to 0.65 inch). Thin rim, if necessary, by removing brass from the FRONT of the rim -- not the rear, which would reduce the depth of the primer pocket.

.320 Short

(CIP maximums)

solid:
112 gr brass
13 gr water



.315 bullet displaces
19.71 grains per inch.

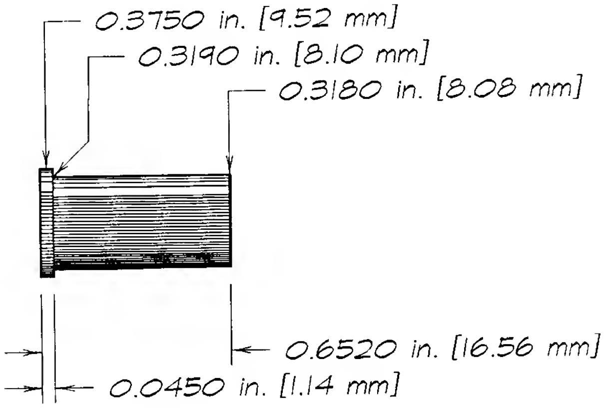
Use factory .320 Long brass. Or trim .32 Long Colt brass to 0.653 inch and deburr. Or use .32 Short Colt brass, which is a bit short.

Anneal only by method shown in text. ***Text explains use of "solid" and displacement figures.***

.320 Short Revolver

(ICI Metals Ltd dwg)

solid:
111 gr brass
13 gr water



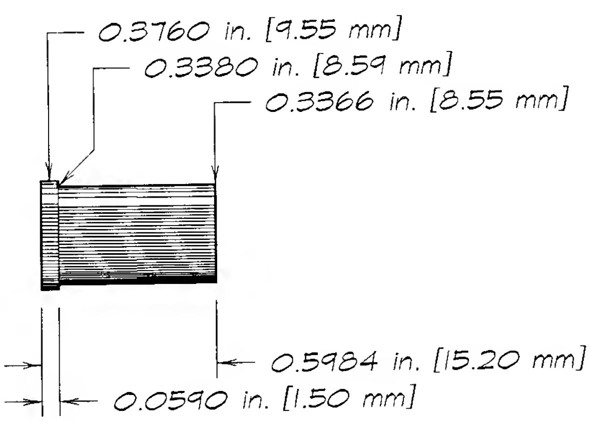
.310 bullet displaces
19.09 grains per inch.

Use factory .320 Long or Short brass. Or trim .32 Long Colt brass to 0.65 inch and deburr. Or use .32 Short Colt brass, which is a bit short.

.320 Smith & Wesson

(Brno drawing, 1948)

solid:
127 gr brass
15 gr water



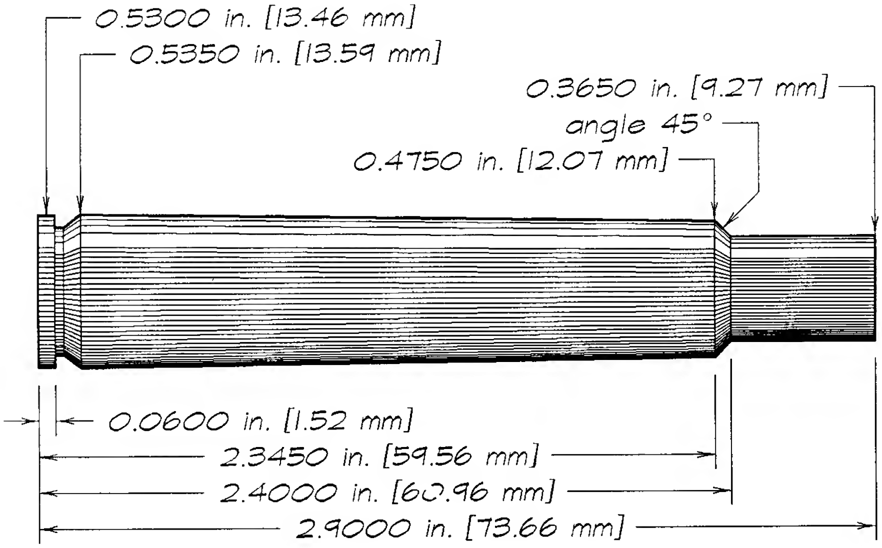
.311 bullet displaces
19.22 grains per inch.

Use .32 S&W brass.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.322 Rigby Nitro (Kynoch drawing, 1914)

solid:
1,157 gr brass
136 gr water

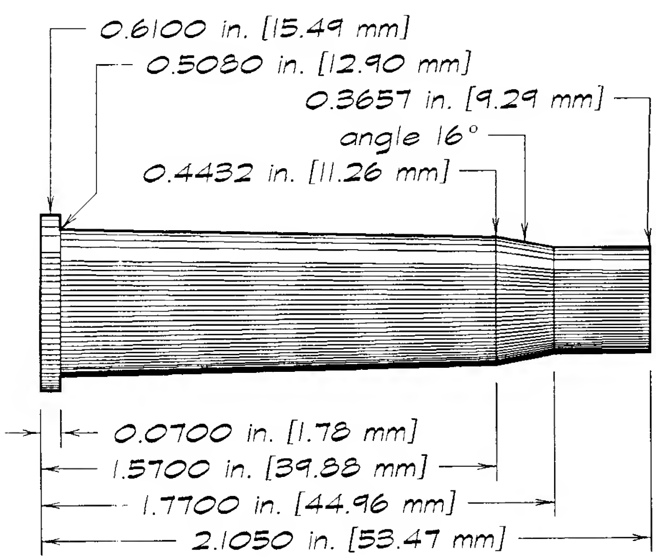


.330 bullet displaces 21.63 grains per inch.

Use .322 Rigby Nitro brass. I don't know of any satisfactory substitute.

.33 Winchester (SAAMI maximums, 1958)

solid:
750 gr brass
88 gr water



.338 bullet displaces 22.69 grains per inch.

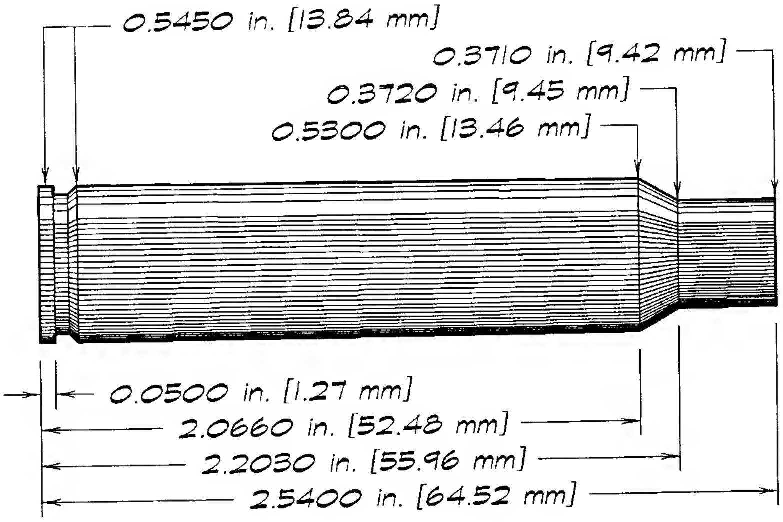
Use recently manufactured .33 Winchester factory brass. Or form from .45-70 Springfield or HDS .45 Basic brass, in respective RCBS form and trim dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.330 Dakota

(Dakota Arms drawing)

solid:
1,118 gr brass
131 gr water

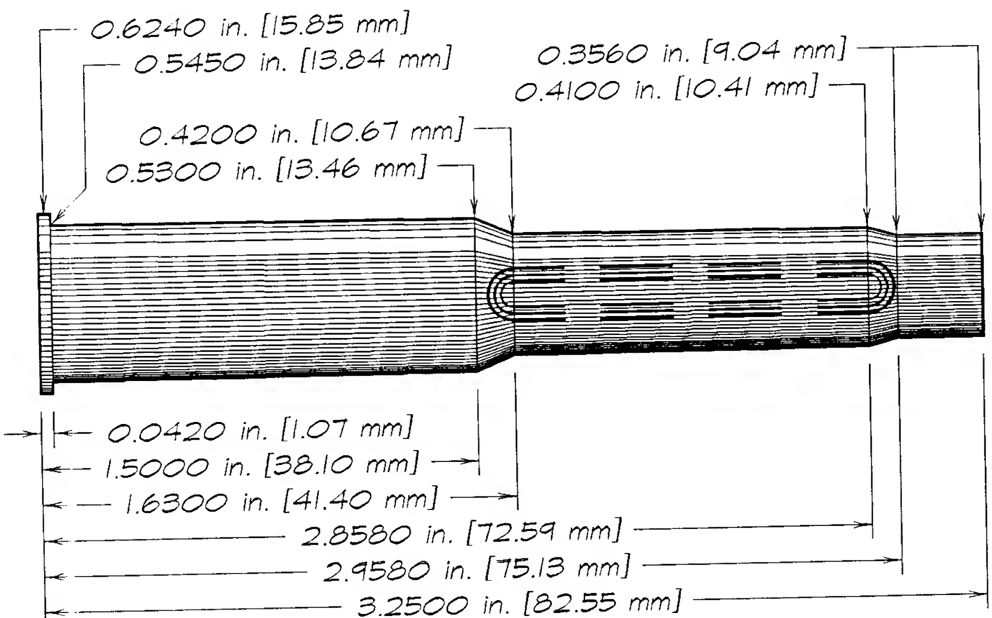


.338 bullet displaces
22.69 grains per inch.

Use .330 Dakota brass. Or anneal neck and shoulder of .404 Jeffery or .404 Jeffery Basic brass and form in RCBS form and trim dies. Ream inside neck, in RCBS neck-ream die. Deburr.

.330 Greener (also called .320)

(Kynoch drawing, 1922 -- from W W Greener dwg)

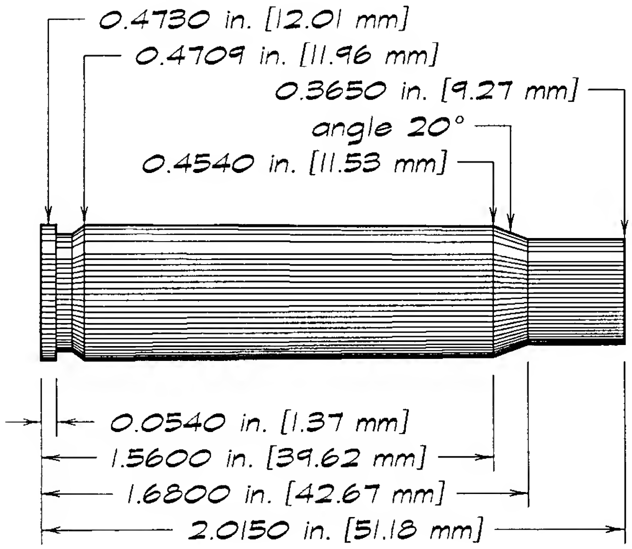


Heavy dashed lines show where one of three grooves is rolled into main neck to align a stack of three nested hollow-base bullets in an indecent arrangement. I have no idea how you can make your own.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.33-.308 (David J LeGate)

solid:
674 gr brass
79 gr water

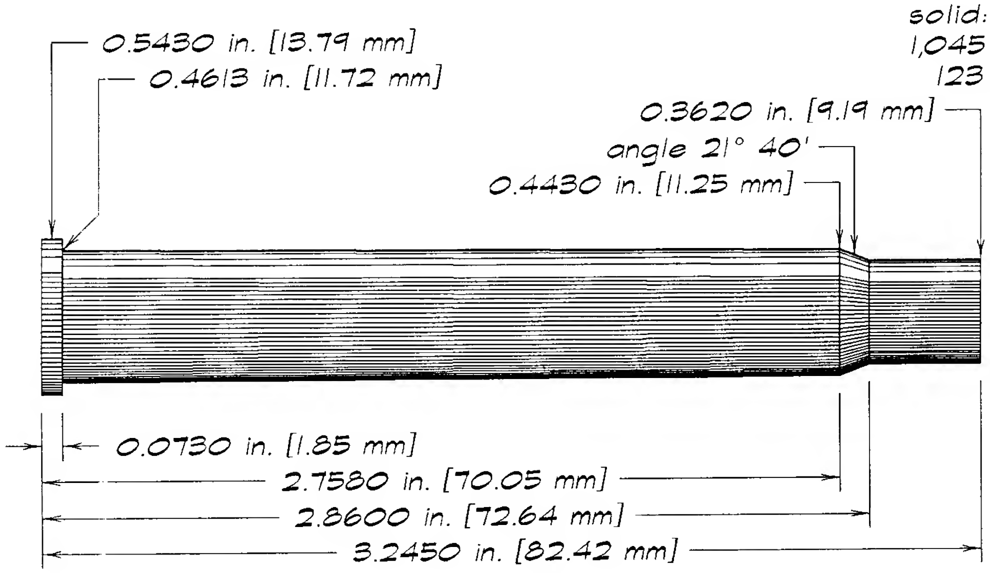


.338 bullet displaces 22.69 grains per inch.

Fire-form .308 Winchester brass with inert filler.

.33x3¼-Inch Davis Express (designer's specs)

solid:
1,045 gr brass
123 gr water



.338 bullet displaces 22.69 grains per inch.

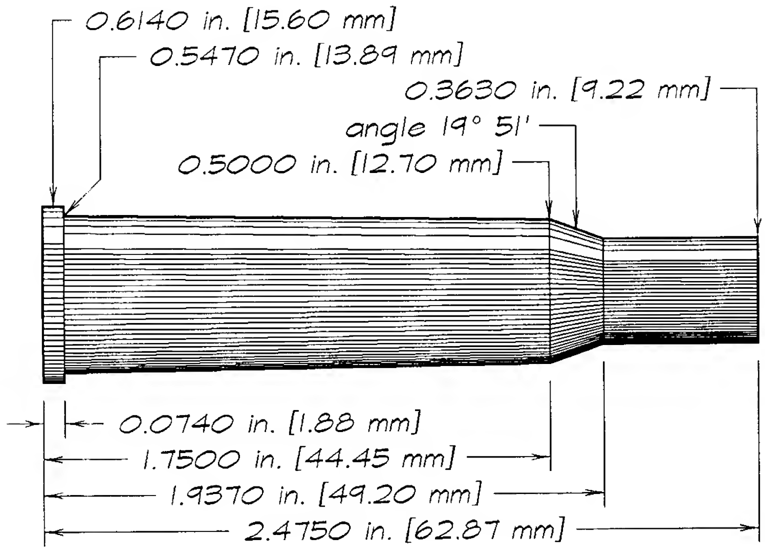
Anneal mouth end of .405 3¼-inch Basic brass (to 1 inch below mouth). Form in RCBS form and trim dies. Trim if necessary. Deburr.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.333 Jeffery Flanged

(ICI Metals Ltd dwg)

solid:
1,001 gr brass
117 gr water



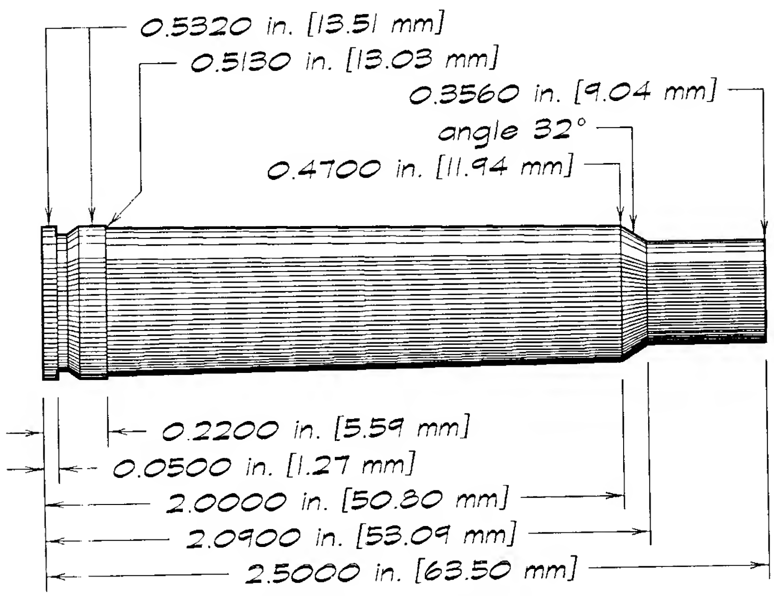
.333 bullet displaces 22.02 grains per inch.

Anneal upper body of .450 NE Basic brass and form in RCBS form, trim, and neck-ream dies.

.333 Express (Luft)

(Speer manual number 4)

solid:
968 gr brass
114 gr water

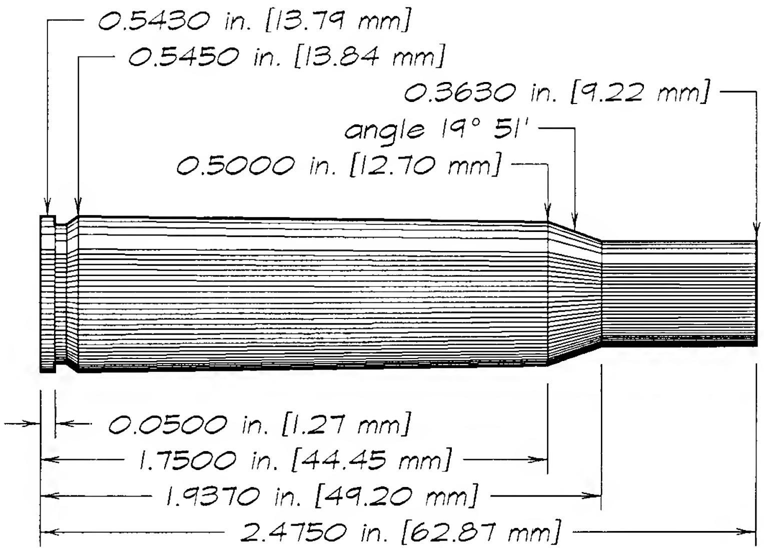


.333 bullet displaces 22.02 grains per inch.

Anneal neck and shoulder of .264 or .300 Winchester Magnum or 7mm Remington Magnum brass. Resize full-length in .333 Express sizer die. Fire-form with inert filler. Trim .300 brass, ream inside neck in RCBS neck-ream die, and deburr.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.333 Jeffery Rimless (ICI Metals Ltd dwg)

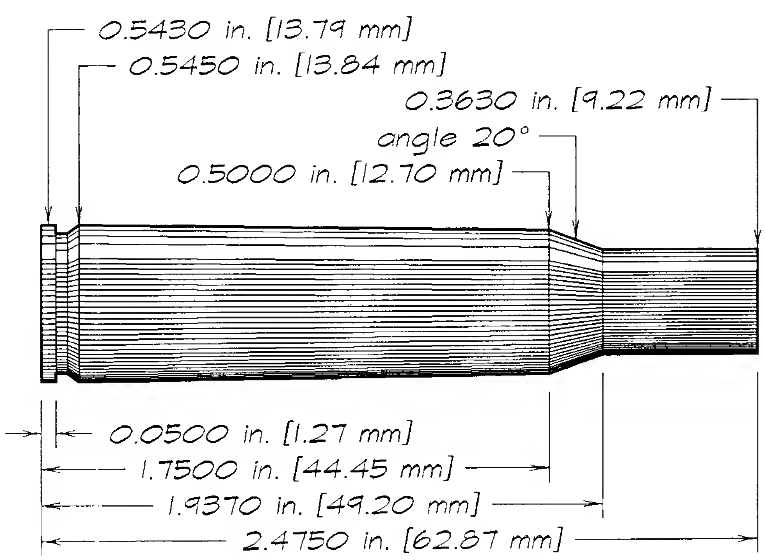


solid:
988 gr brass
116 gr water

.335 bullet displaces
22.29 grains per inch.

Use factory .333 brass. Or anneal neck and shoulder of .404 Jeffery or .404 Basic brass, then form and trim in respective RCBS form and trim dies. Deburr. Ream neck, in RCBS neck-ream die. Fire-form with inert filler.

.333 Rimless Nitro Express (Birmingham Proof House)



solid:
988 gr brass
116 gr water

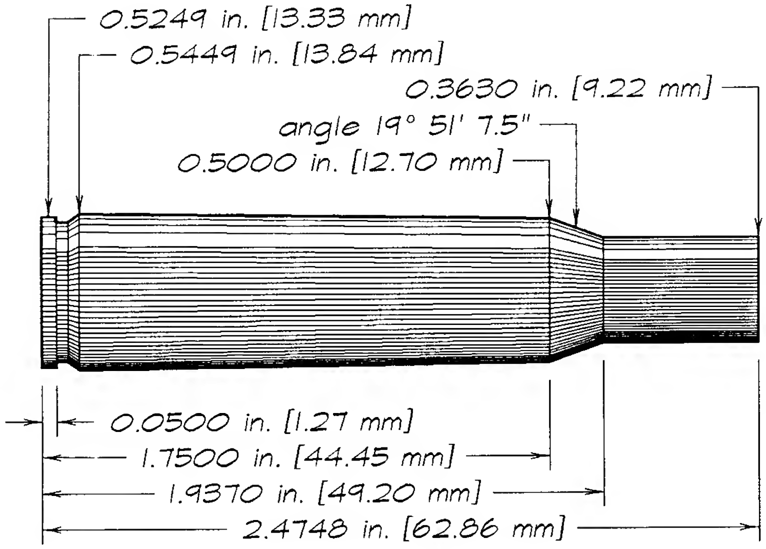
.333 bullet displaces
22.02 grains per inch.

Use factory .333 Rimless Nitro Express brass. Or anneal neck and shoulder of .404 Jeffery or .404 Basic brass, then form and trim in respective RCBS form-and-trim die. Deburr. Fire-form with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.333 Rimless Nitro Express

(CIP maximums)



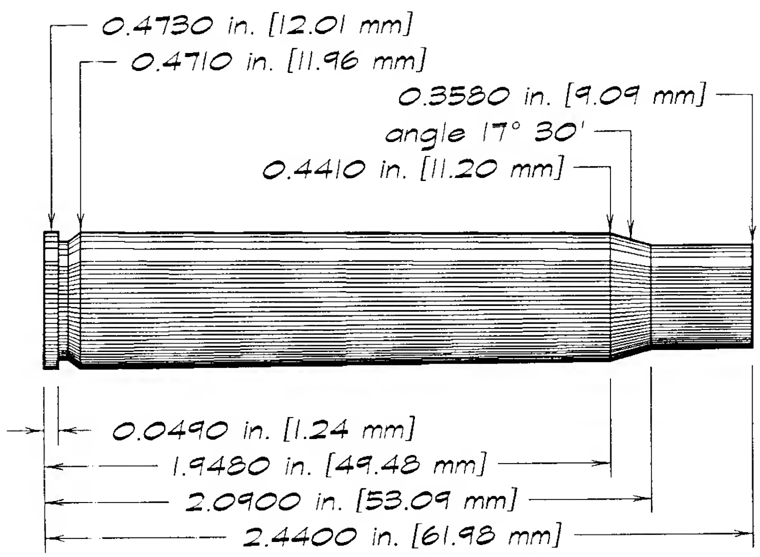
solid:
987 gr brass
116 gr water

.333 bullet displaces
22.02 grains per inch.

Use factory .333 Rimless Nitro Express brass. Or anneal neck and shoulder of .404 Jeffery or .404 Basic brass, then form and trim in respective RCBS form-and-trim die. Deburr. Fire-form with inert filler.

.333 OKH

(Speer manual number 4)



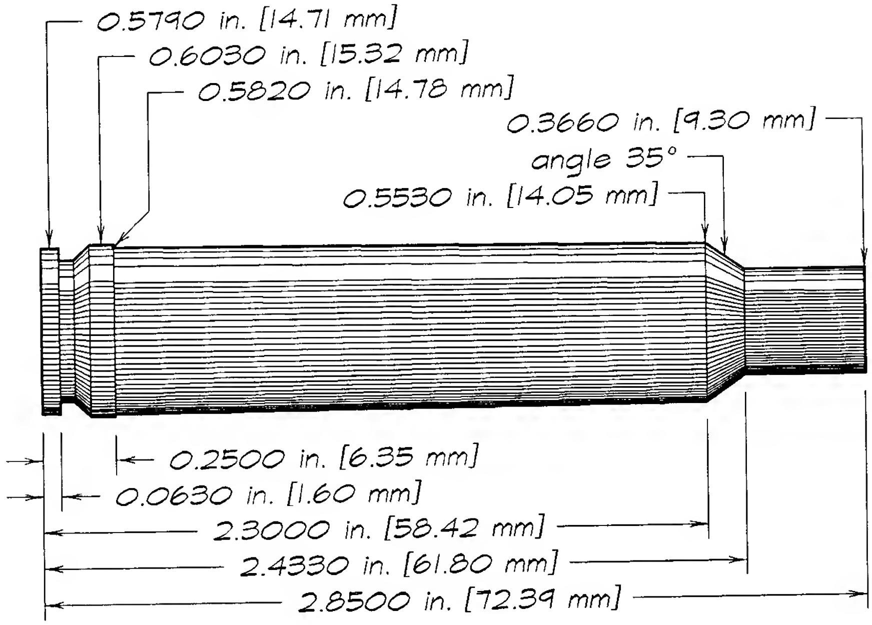
solid:
812 gr brass
95 gr water

.333 bullet displaces
22.02 grains per inch.

Resize .35 Whelen brass full-length in .333 OKH sizer die. Or fire-form .30-06 Springfield brass with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.338 A-Square (A-Square maximums)

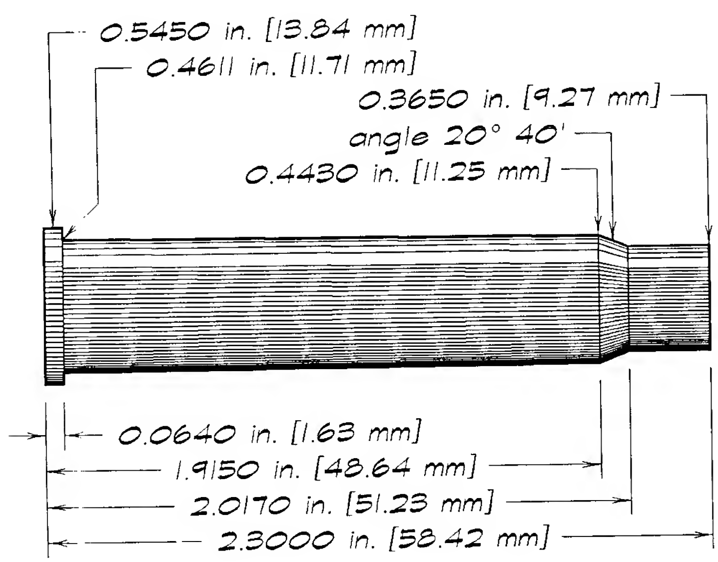


solid:
1,434 gr brass
168 gr water

.338 bullet displaces 22.69 grains per inch.

Use A-Square or A-Cube factory brass. Or anneal neck and shoulder of .378 Weatherby Magnum or .460 Weatherby Magnum brass and form in RCBS form-and-trim die. Ream inside neck, in RCBS neck-ream die. Deburr.

.338 Davis Krag Number 2 (designer's specs)



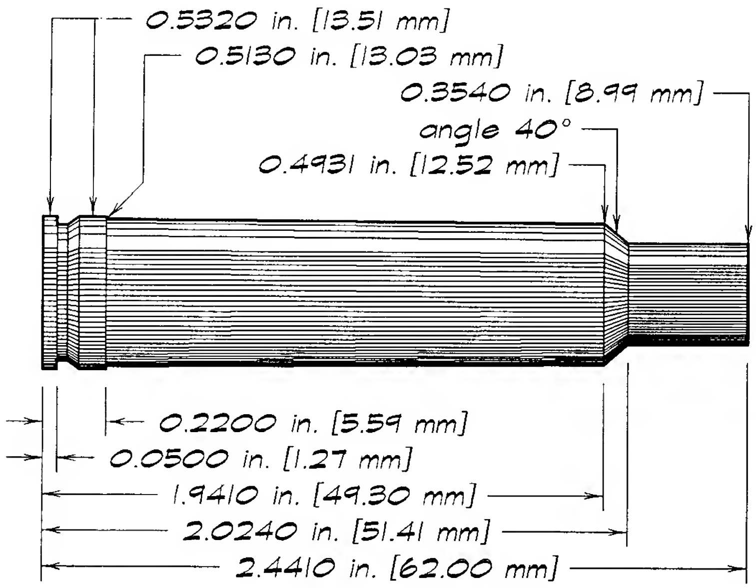
solid:
743 gr brass
87 gr water

.338 bullet displaces 22.69 grains per inch.

Anneal neck, shoulder, and upper body of .30-40 Krag brass. Fire-form with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.338 Hayes Magnum (designer's drawing)

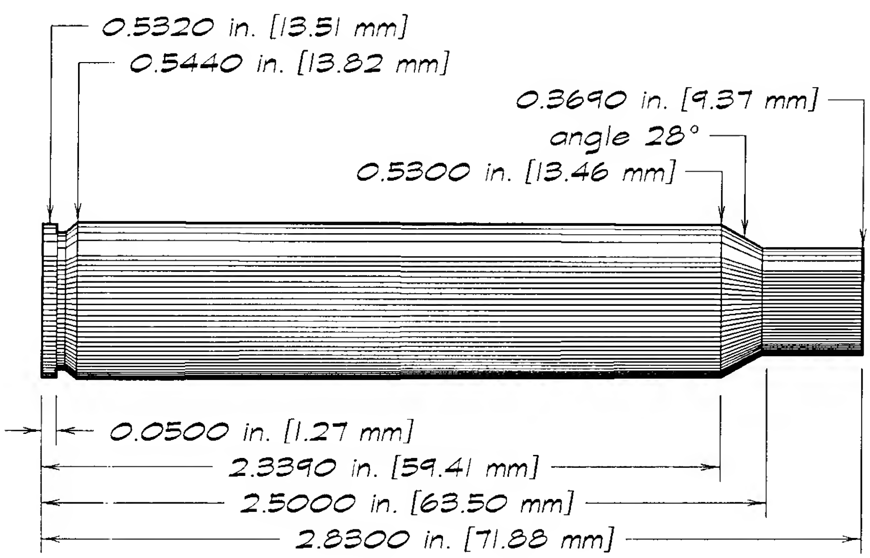


solid:
963 gr brass
113 gr water

.323 bullet displaces
20.72 grains per inch.

Anneal neck and shoulder of .338 Winchester Magnum brass and resize full-length in 8x62mm Hayes sizer die. Trim to 2.44 inches; deburr. Fire-form with inert filler.

.338 Imperial Magnum (Imperial drawing)



solid:
1,249 gr brass
147 gr water

.338 bullet displaces
22.69 grains per inch.

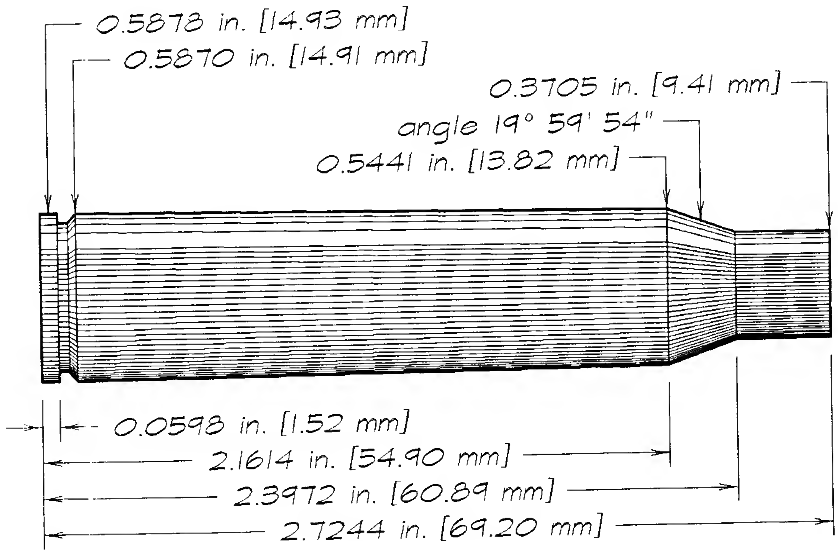
Use .338 Imperial Magnum brass. Or anneal neck and shoulder area of .404 Jeffery Basic brass and form in RCBS form and trim dies. Ream inside neck, in RCBS neck-ream die. Deburr.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.338 Lapua Magnum

(CIP maximums)

solid:
1,346 gr brass
158 gr water



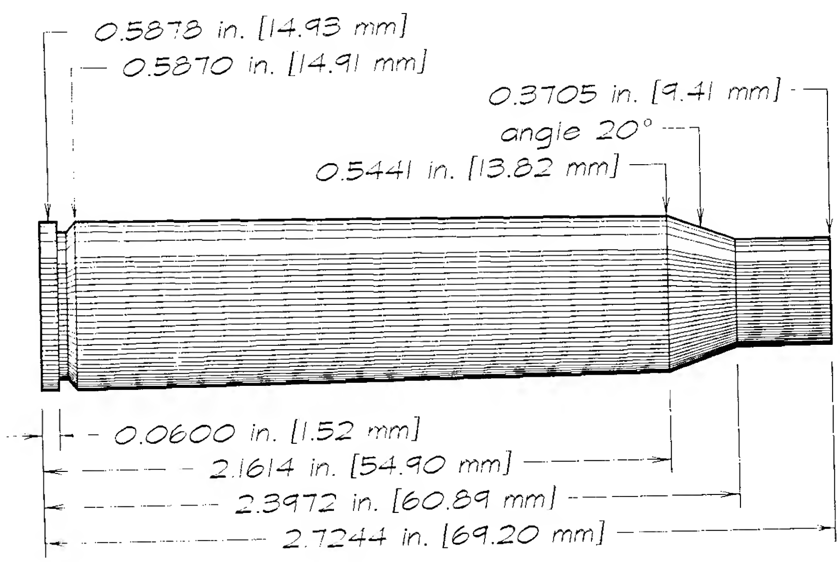
.338 bullet displaces
22.69 grains per inch.

Use .338 Lapua Magnum brass. Or form from .416 Rigby Basic brass, in RCBS form, trim, and ream dies. Fire-form with inert filler.

.338 Lapua Magnum

(Lapua drawing)

solid:
1,345 gr brass
158 gr water



.338 bullet displaces
22.69 grains per inch.

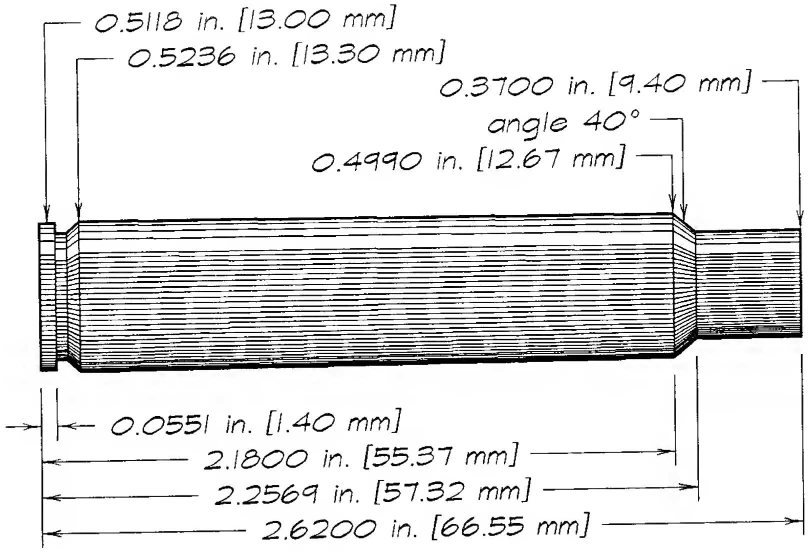
Use .338 Lapua Magnum brass. Or form from .416 Rigby Basic brass, in RCBS form, trim, and ream dies. Fire-form with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.338 OAM (Norway)

(Ole A Molvaer drawing)

solid:
985 gr brass
116 gr water



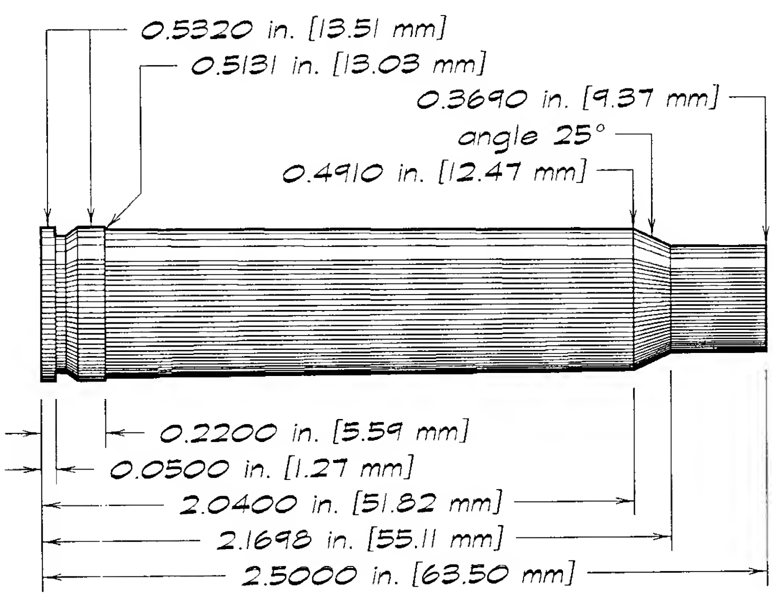
.338 bullet displaces
22.69 grains per inch.

Resize 8x68mm S brass full-length in body of .338 OAM sizer die. Trim to 2.62 inches, fire-form with inert filler, ream inside neck, and deburr.

.338 Winchester Magnum

(SAAMI maximums)

solid:
1,019 gr brass
120 gr water



.338 bullet displaces
22.69 grains per inch.

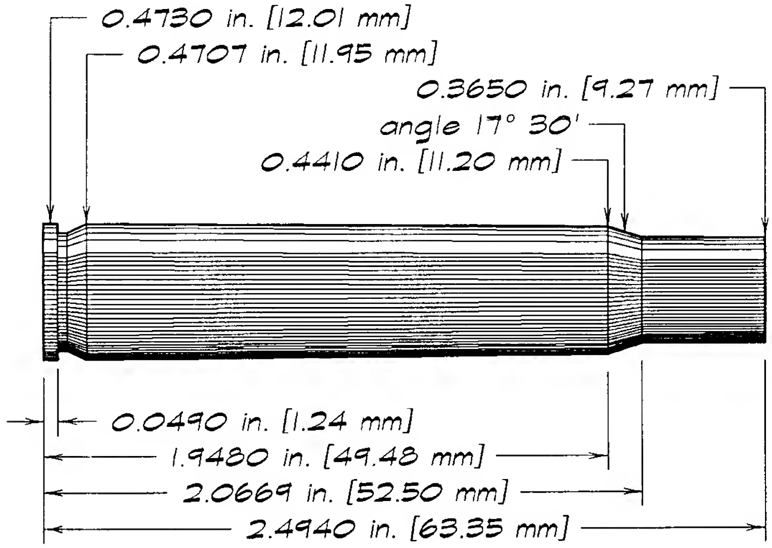
Use factory-made .338 Winchester Magnum brass. Or fire-form .300 Winchester or .300 H&H Magnum brass with inert filler. Or form from .375 H&H Magnum brass, in RCBS form die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.338-06

(designer's specs)

solid:
826 gr brass
97 gr water



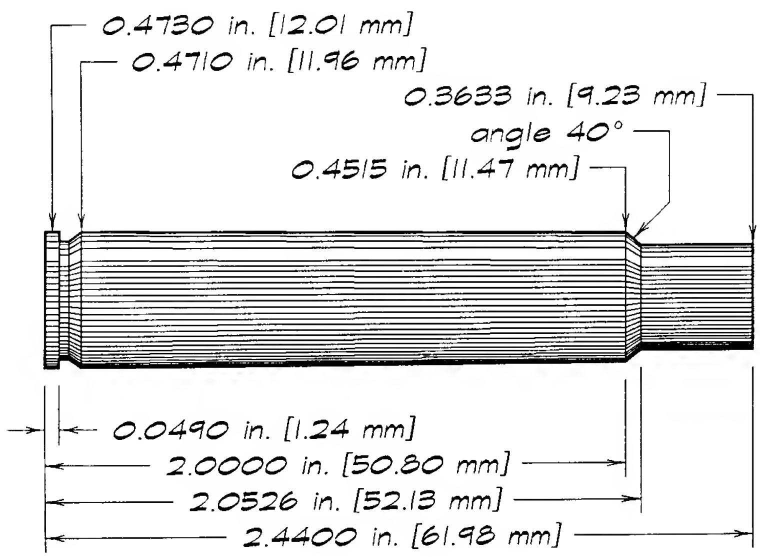
.338 bullet displaces 22.69 grains per inch.

Resize .35 Whelen brass full-length in .338-06 sizer die. Or anneal neck and shoulder of .30-06 Springfield brass and fire-form with inert filler.

.338-06 Ackley Improved

(unsigned dwg)

solid:
822 gr brass
96 gr water



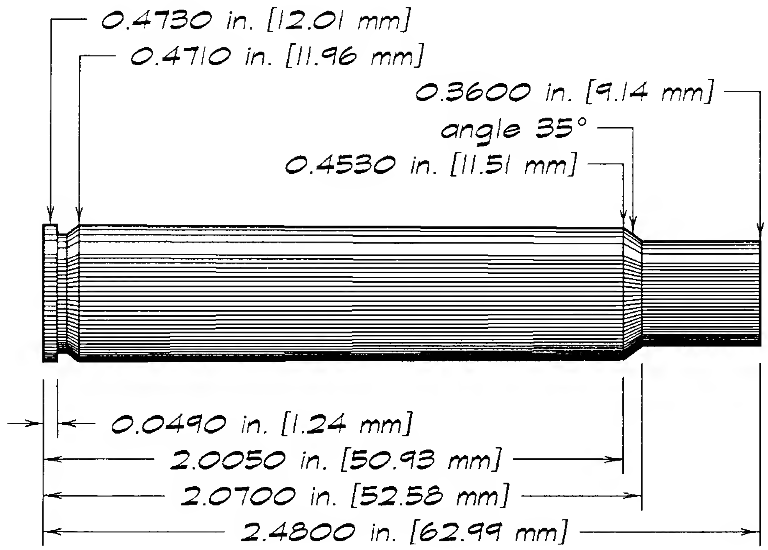
.338 bullet displaces 22.69 grains per inch.

Resize .35 Whelen brass full-length in .338-06 Ackley sizer die. Fire-form with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.338-06 Davis Improved (designer's specs)

solid:
834 gr brass
98 gr water

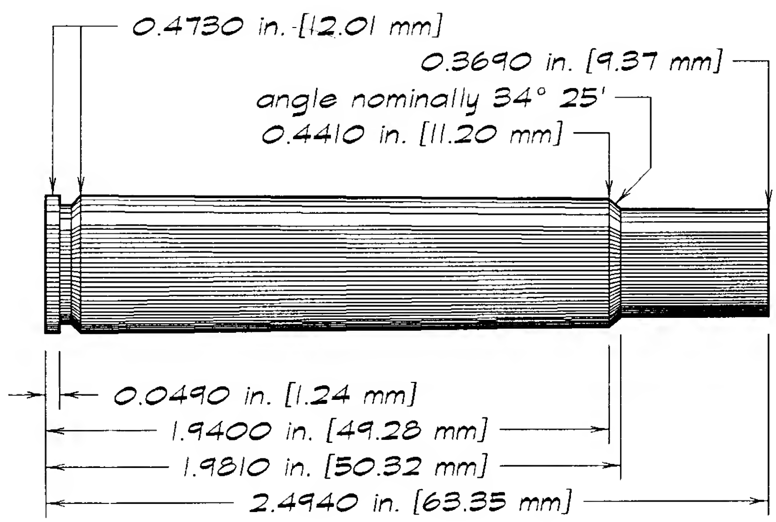


.338 bullet displaces
22.69 grains per inch.

Anneal neck, shoulder, and upper body of .30-06 Springfield or .35 Whelen brass. Fire-form .30-06 brass with inert filler. Resize .35 Whelen brass full-length in .338-06 Davis Improved sizer die and fire-form with inert filler.

.338-06 Express (unidentified drawing)

solid:
823 gr brass
97 gr water



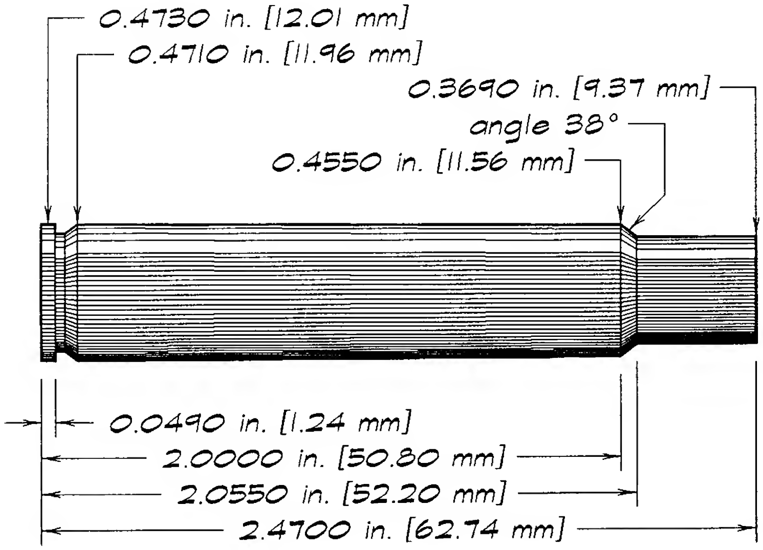
.338 bullet displaces
22.69 grains per inch.

Resize .35 Whelen case full-length in .338-06 die. Fire-form with inert filler. Or anneal neck and shoulder of .30-06 case and fire-form with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.338-06 Improved

(David J LeGate)



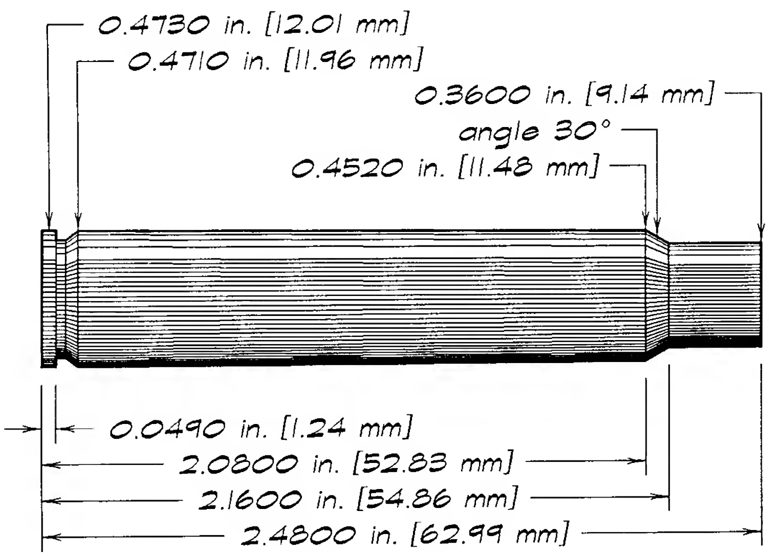
solid:
836 gr brass
98 gr water

.338 bullet displaces
22.69 grains per inch.

Resize .35 Whelen brass full-length in .338-06 Improved sizer die. Or fire-form .30-06 Springfield brass with inert filler. Trim to length and deburr.

.338-06 Max M

(designer's specs)



solid:
844 gr brass
99 gr water

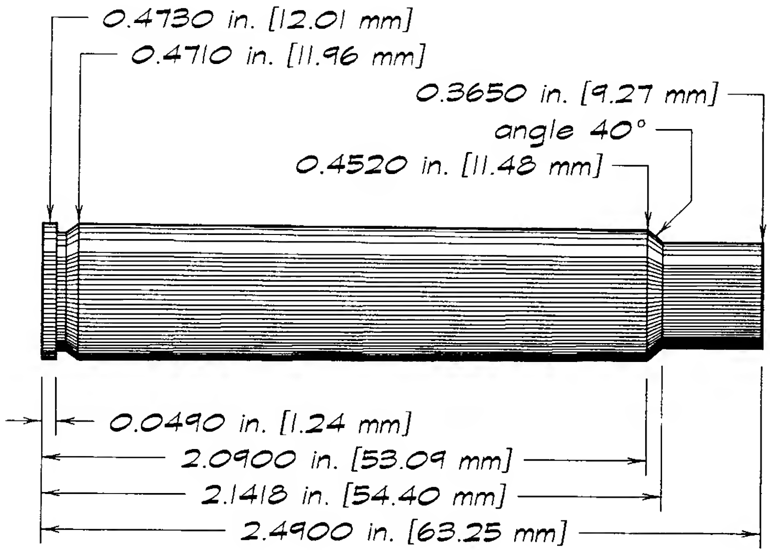
.338 bullet displaces
22.69 grains per inch.

Anneal neck, shoulder, and upper body of .35 Whelen brass. Resize full-length in .338-06 Max M sizer die. Fire-form with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.338-.270 HGT

(David J LeGate)



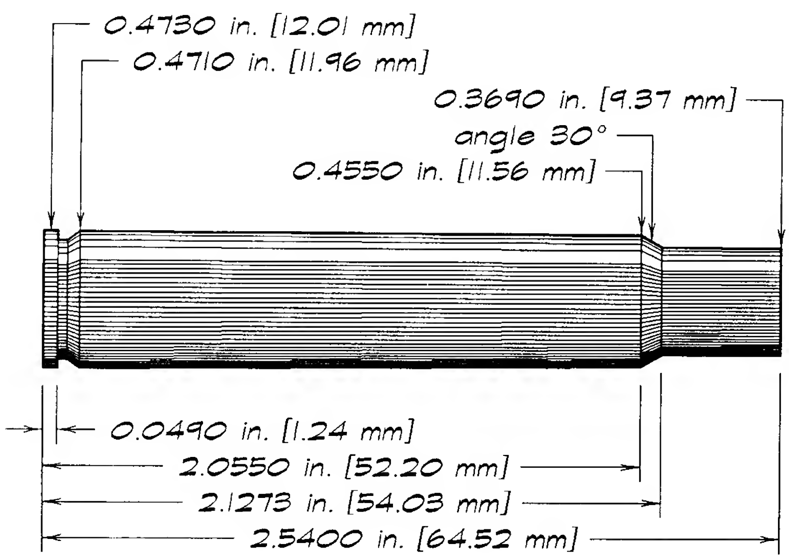
solid:
849 gr brass
100 gr water

.338 bullet displaces
22.69 grains per inch.

Resize .35 Whelen brass full-length in .338-.270 HGT sizer die, then fire-form with inert filler.

.338-.280 RCBS (Howell)

(designer's specs)



solid:
860 gr brass
101 gr water

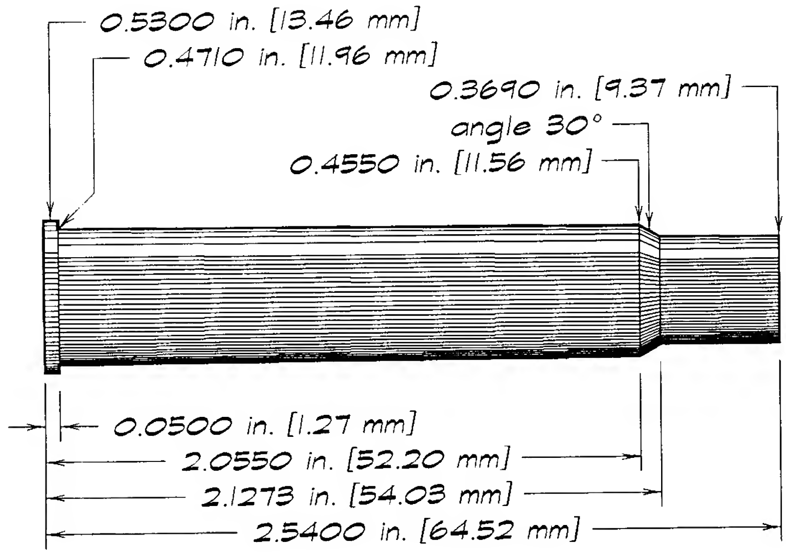
.338 bullet displaces
22.69 grains per inch.

Fire-form .280 Remington brass with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.338-.280 Improved Rimmed

(designer's specs)



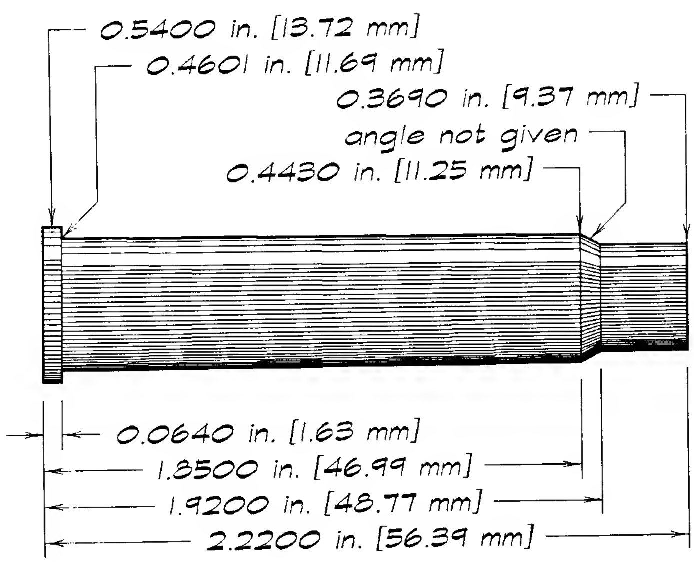
solid:
897 gr brass
105 gr water

.338 bullet displaces 22.69 grains per inch.

Trim .400-.350 NE brass to 2.6 inches and resize full-length in .338-.280 Improved Rimmed sizer die. Fire-form with inert filler, trim to 2.54 inches, and deburr mouth.

.338-.303 British

(Ken Waters; SAAMI)



solid:
710 gr brass
83 gr water

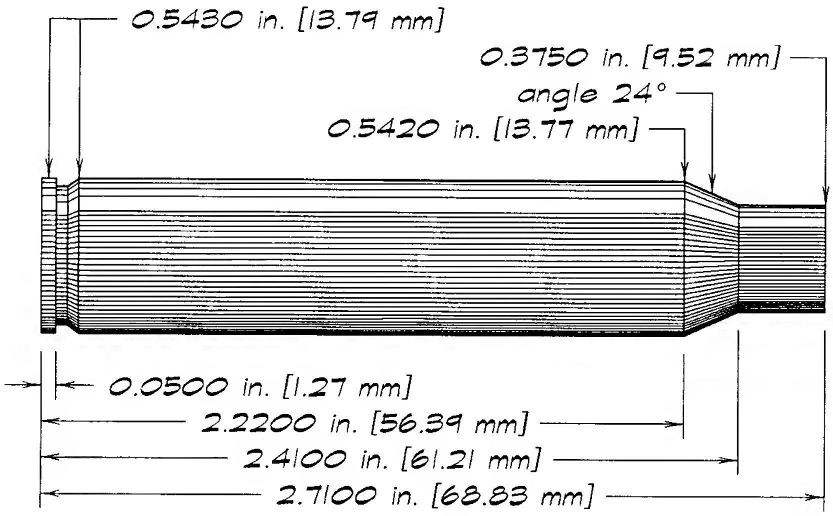
.338 bullet displaces 22.69 grains per inch.

Fire-form .303 British cases with inert filler.

Anneal only by method shown in text. *Text explains use of "solid" and displacement figures.*

.338-.416 Rigby (Keberst Int'l drawing)

solid:
1,216 gr brass
143 gr water

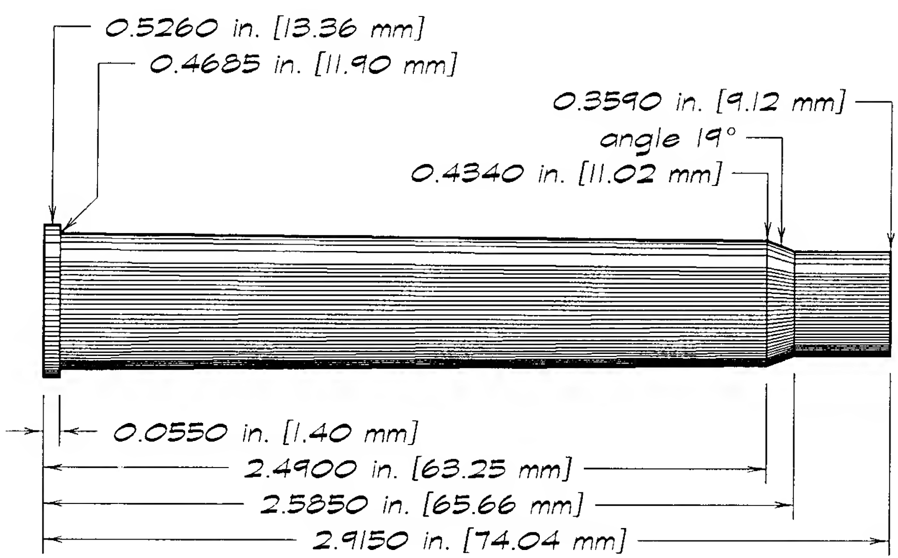


.338 bullet displaces 22.69 grains per inch.

Anneal neck and shoulder of .416 Rigby or Rigby Basic brass. Form, trim, and ream in RCBS form, trim, and neck-ream dies.

.338-74 Keith (David J LeGate)

solid:
963 gr brass
113 gr water



.338 bullet displaces 22.69 grains per inch.

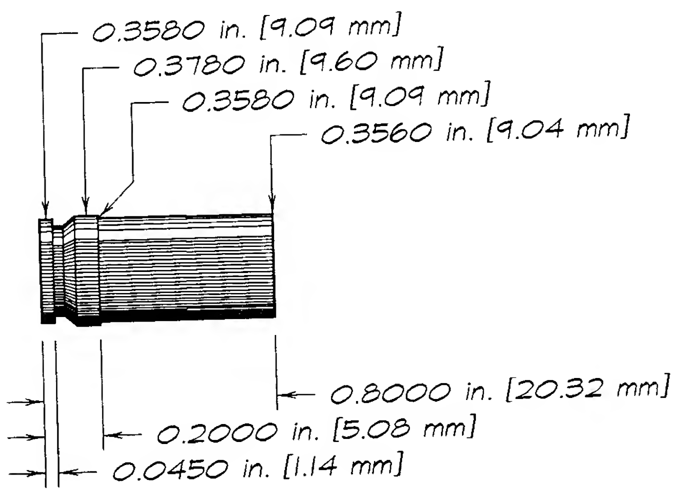
Resize 9.3x74mm Rimmed brass full-length in .338-74 Keith sizer die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.34 BSA Auto Pistol Cartridge

(Kynoch drawing, 1921)

solid:
176 gr brass
21 gr water

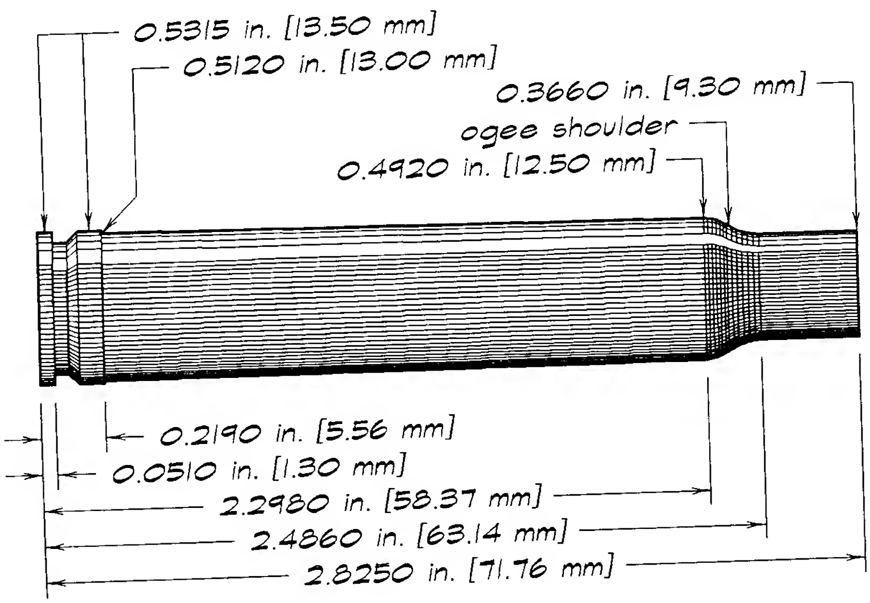


After one brief look at this drawing, you know as much about this cartridge as I do. I can't tell you which brass to use, other than .34 BSA Auto factory brass.

.340 Weatherby Magnum

(SAAMI maximums, 1986)

solid:
1,141 gr brass
134 gr water



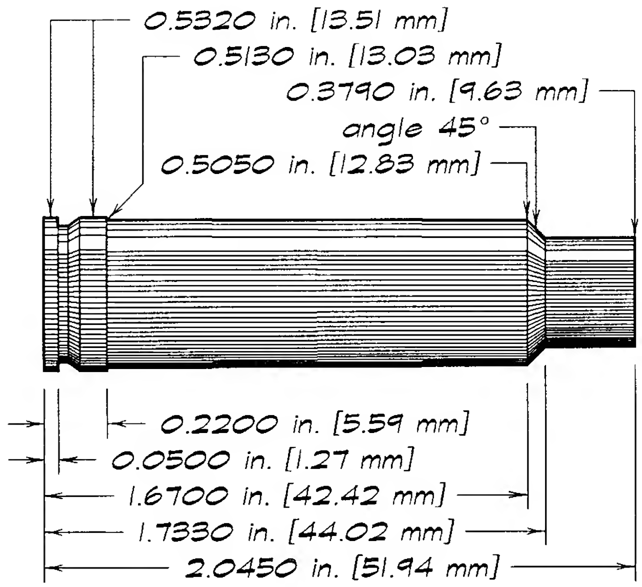
.338 bullet displaces 22.69 grains per inch.

Use .340 Weatherby Magnum brass. Or form from .375 H&H Magnum brass.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.348 Davis Short Magnum (designer's specs)

solid:
848 gr brass
100 gr water

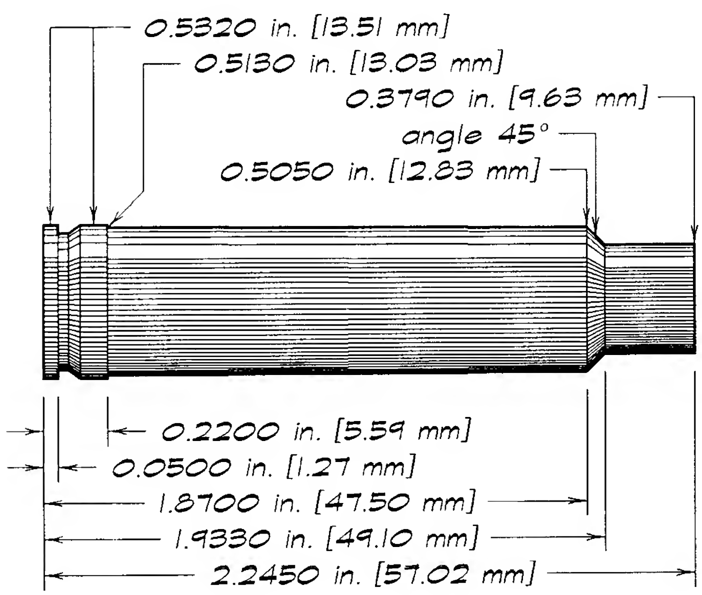


.348 bullet displaces
24.05 grains per inch.

Anneal neck, shoulder, and upper body of .350 Remington Magnum brass. Resize full-length in .348 DSM sizer die. Fire-form with inert filler. Trim to 2.045 inches and deburr. Ream inside neck if necessary.

.348 Davis Short Magnum Number 2 (designer's specs)

solid:
938 gr brass
110 gr water



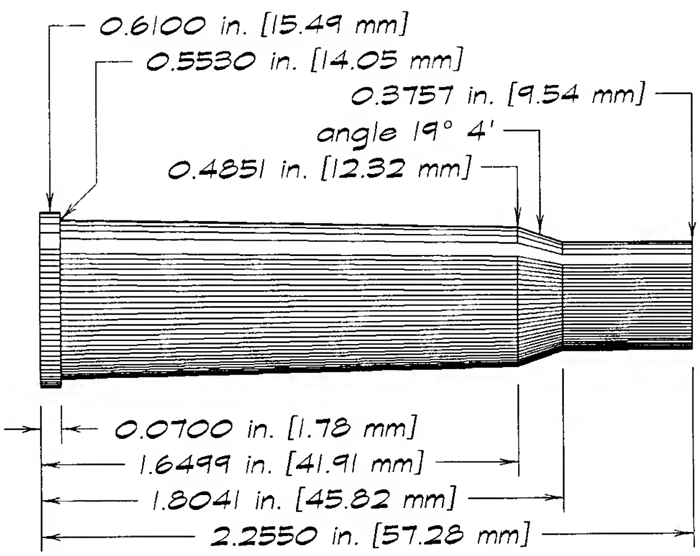
.348 bullet displaces
24.05 grains per inch.

Anneal neck, shoulder, and upper body of .350 Remington Magnum brass. Resize full-length in .348 DSM No. 2 sizer die. Fire-form with inert filler. Trim. Deburr.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.348 Winchester

(SAAMI maximums)



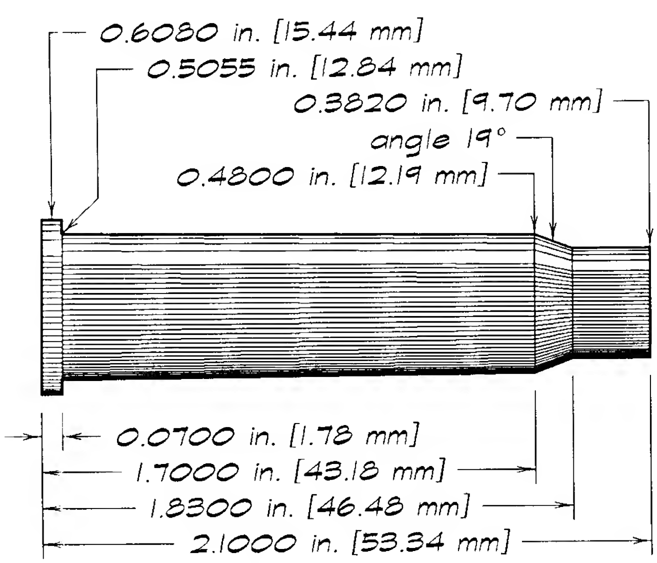
solid:
928 gr brass
109 gr water

.348 bullet displaces
24.05 grains per inch.

Use factory .348 Winchester brass.

.35 Greevy Express

(David J LeGate)



solid:
826 gr brass
97 gr water

.358 bullet displaces
25.46 grains per inch.

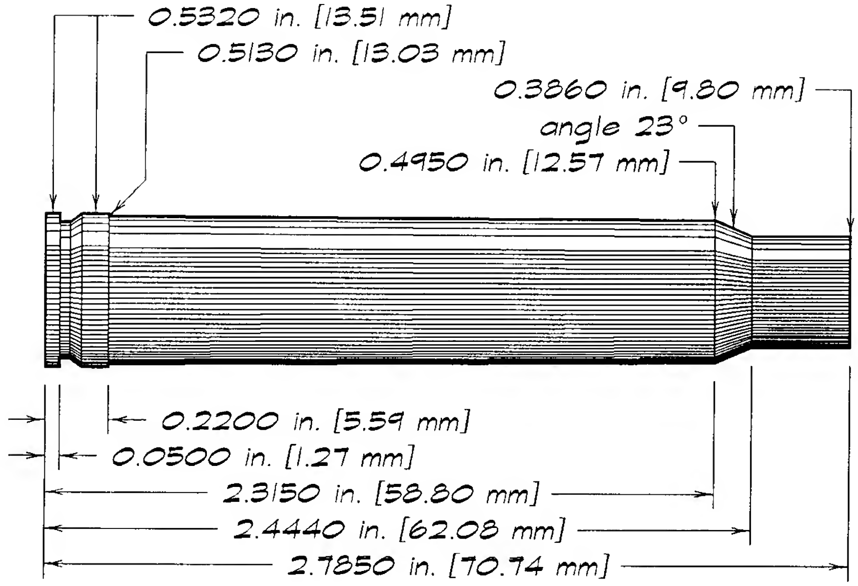
Anneal mouths of .45-70 Government brass and resize full-length in .35 Greevy Express sizer die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.35 Griffin & Howe Magnum

(Speer manual number 4)

solid:
1,160 gr brass
136 gr water



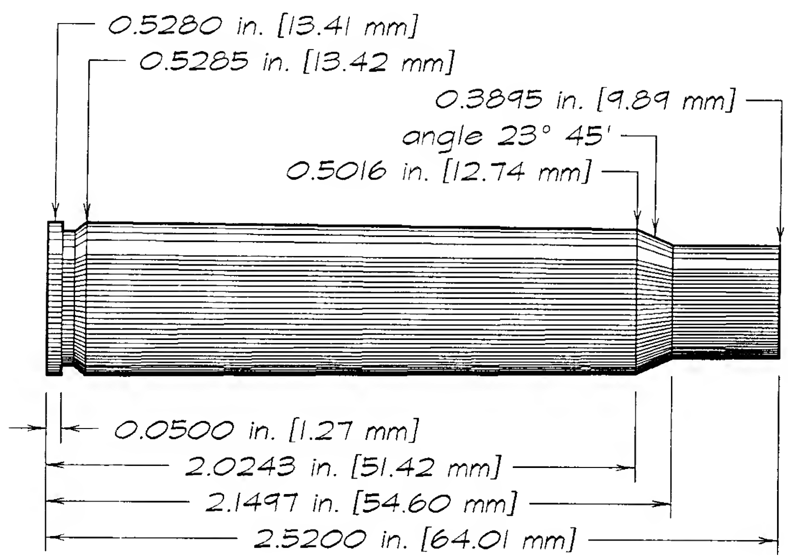
.358 bullet displaces
25.46 grains per inch.

Anneal neck and shoulder of .300 or .375 H&H Magnum brass. Fire-form .300 H&H brass with inert filler. Resize .375 H&H Magnum brass full-length in .35 G&H Magnum sizer die, then fire-form with inert filler. Trim and deburr.

.35 Newton

(Western Ctg Co dwg)

solid:
1,048 gr brass
123 gr water



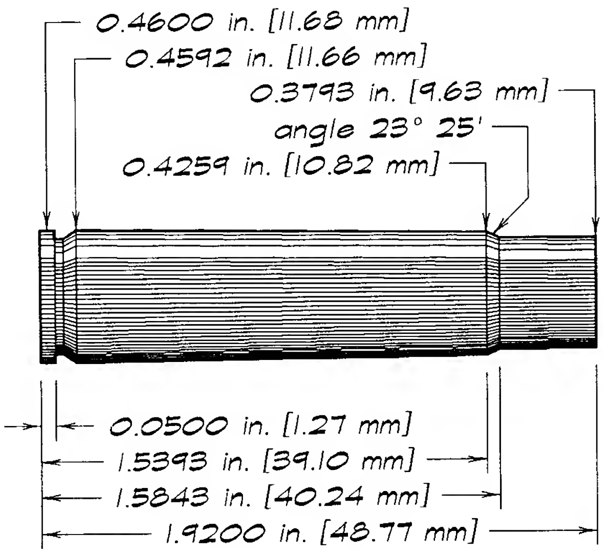
.357 bullet displaces
25.31 grains per inch.

Form from 8x68mm S brass, in RCBS form and trim dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.35 Remington

(SAAMI maximums)



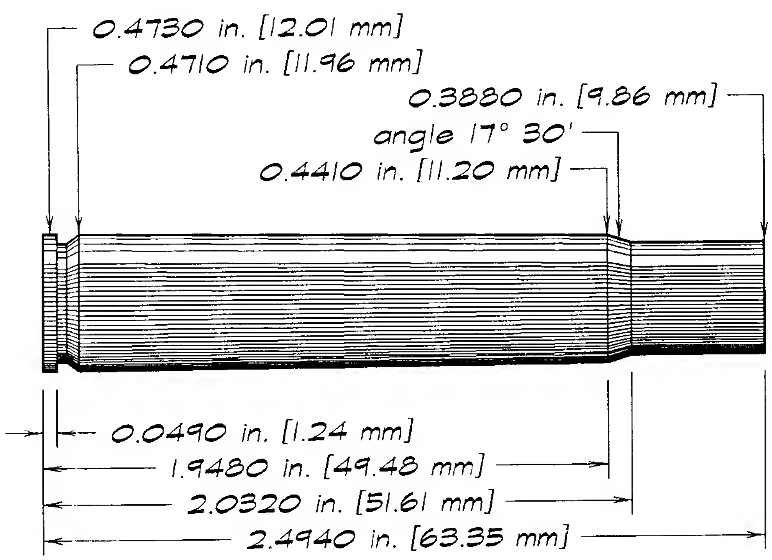
solid:
612 gr brass
72 gr water

.358 bullet displaces
25.46 grains per inch.

Use recently manufactured .35 Remington brass. Or form from .30-06 Springfield brass, in RCBS form-and-trim die.

.35 Whelen

(SAAMI maximums)



solid:
837 gr brass
98 gr water

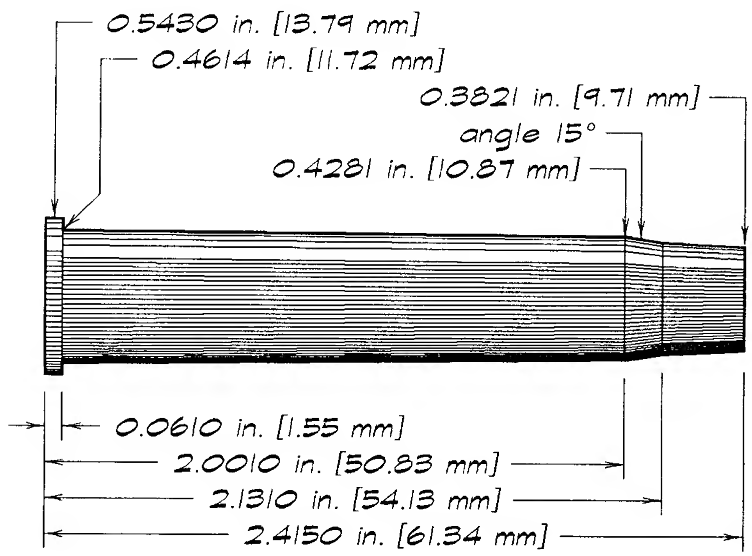
.358 bullet displaces
25.46 grains per inch.

Use factory .35 Whelen cases. Or fire-form .30-06 Springfield brass (military or commercial) with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.35 Winchester (SAAMI maximums, 1958)

solid:
776 gr brass
91 gr water

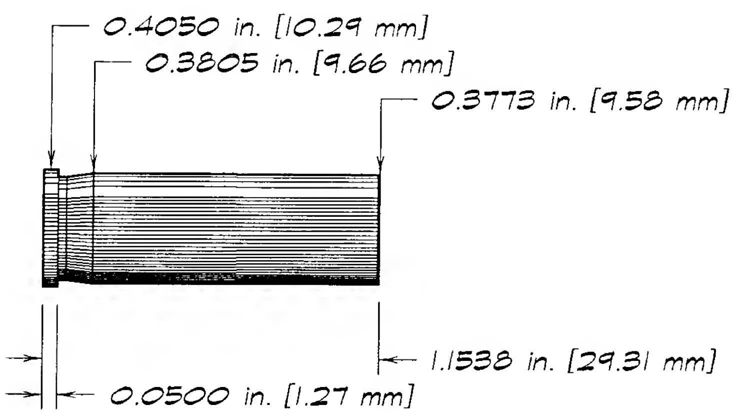


.358 bullet displaces 25.46 grains per inch.

Use recently manufactured .35 Winchester brass. Or form from 7x65mm Rimmed brass, in RCBS form and trim dies.

.35 Winchester Self-Loading (SAAMI maximums, 1959)

solid:
269 gr brass
32 gr water



.352 bullet displaces 24.61 grains per inch.

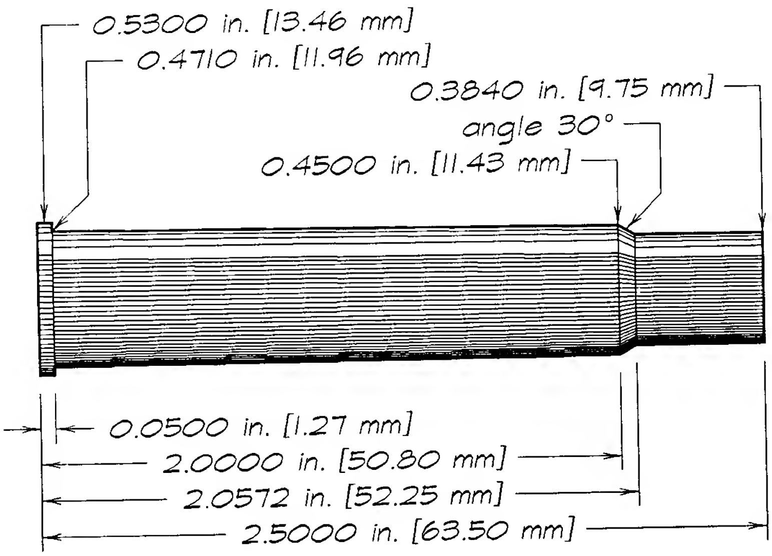
Form from .357 Magnum brass, in RCBS case-forming dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.35-06 Rimmed

(designer's specs)

solid:
878 gr brass
103 gr water



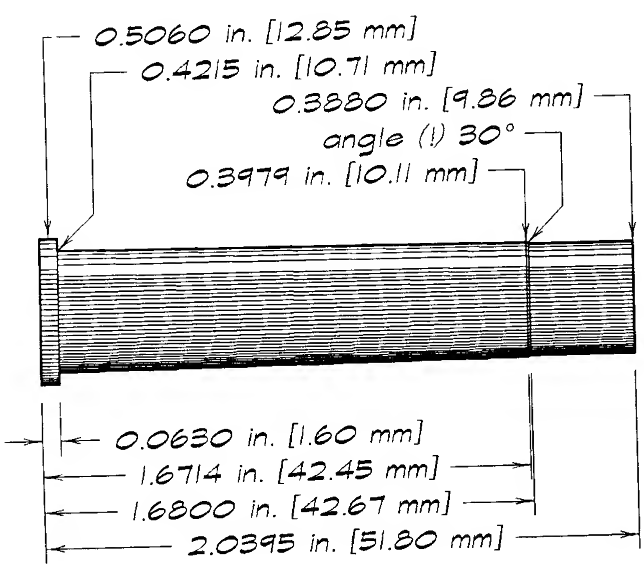
.358 bullet displaces 25.46 grains per inch.

Trim .400-.350 NE brass to 2½ inches and resize full-length in .35-06 Rimmed sizer die. Fire-form with inert filler. Trim to 2.5 inches and deburr.

.35-30 Winchester

(designer's specs)

solid:
540 gr brass
63 gr water



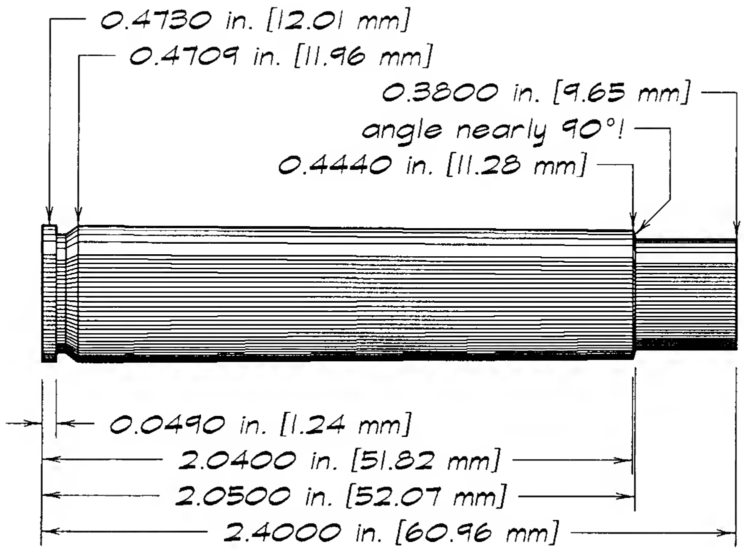
.358 bullet displaces 25.46 grains per inch.

Fire-form .30-30 Winchester or .32 Winchester Special brass with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.35-.318 Westley Richards (Ken Waters)

solid:
818 gr brass
96 gr water

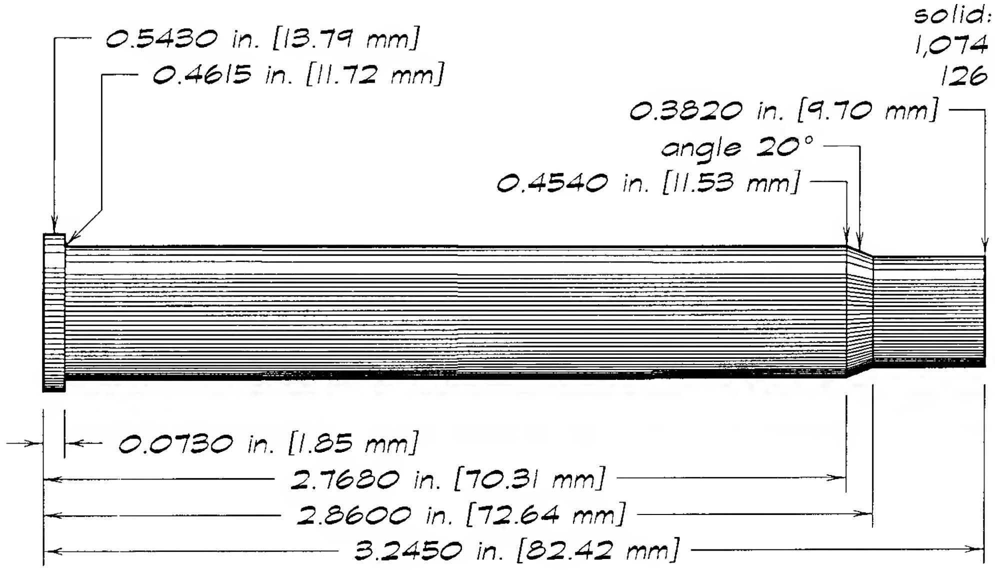


.358 bullet displaces 25.46 grains per inch.

Fire-form .30-06 Springfield brass with inert filler. Trim to 2.40 inches. Deburr.

.35x3¼-Inch Davis Express (designer's specs)

solid:
1,074 gr brass
126 gr water



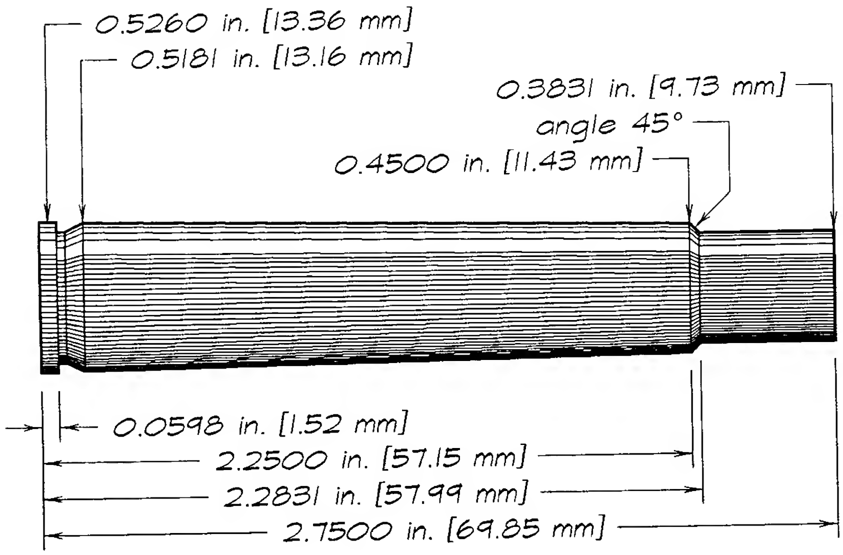
.358 bullet displaces 25.46 grains per inch.

Anneal mouth end of .405 3¼-inch Basic brass. Resize full-length in .35x3¼ DE sizer die. Trim. Deburr.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.350 Magnum Rigby (CIP maximums)

solid:
1,061 gr brass
124 gr water

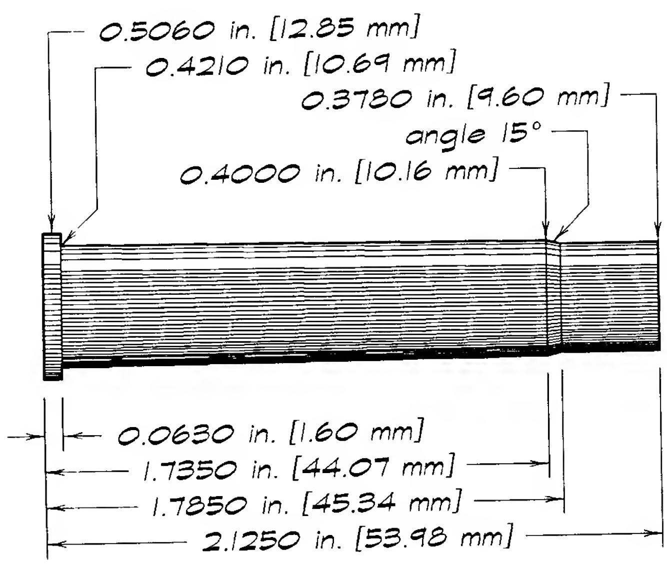


.357 bullet displaces 25.31 grains per inch.

Use factory .350 Magnum Rigby brass. Or turn belt off .375 H&H Magnum brass and form in RCBS form-and-trim die. Trim. Deburr.

.350 Maine Guide I (Ken Waters)

solid:
611 gr brass
72 gr water

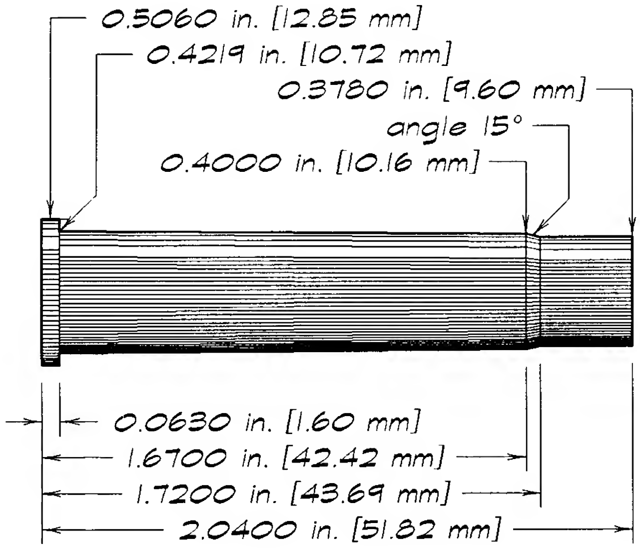


.358 bullet displaces 25.46 grains per inch.

Resize .38-55 Winchester brass full-length in .350 Maine Guide I sizer die. DO NOT CONFUSE this cartridge with the .350 Maine Guide II, based on the .32 Winchester Special case.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.350 Maine Guide II (Ken Waters)

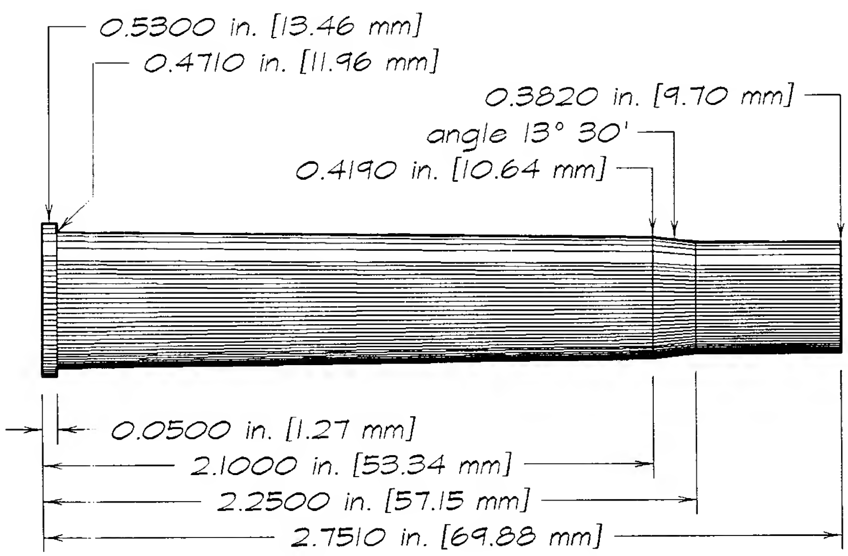


solid:
587 gr brass
69 gr water

.358 bullet displaces
25.46 grains per inch.

Fire-form .32 Winchester Special brass with inert filler.
DO NOT CONFUSE this cartridge with the .350 Maine Guide I, based on the .38-55 Winchester case.

.350 Number 2 Rigby (Birmingham Proof House)



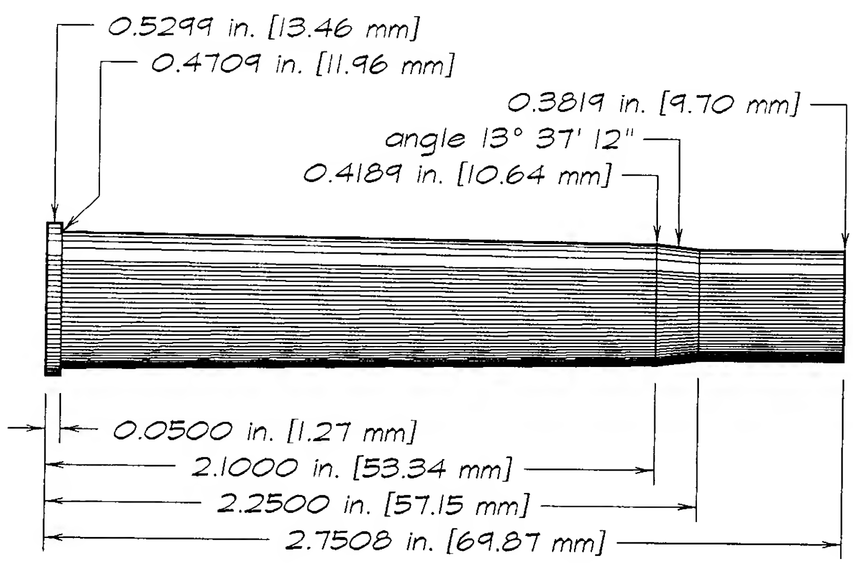
solid:
890 gr brass
104 gr water

.356 bullet displaces
25.17 grains per inch.

Use recently manufactured .350 Number 2 brass. Or anneal forward portion of .405 Basic brass, turn rim to 0.525-0.530 inch, thin rim (from front, to keep from reducing depth of primer pocket), and form in RCBS form dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.350 Number 2 Rigby (CIP maximums)

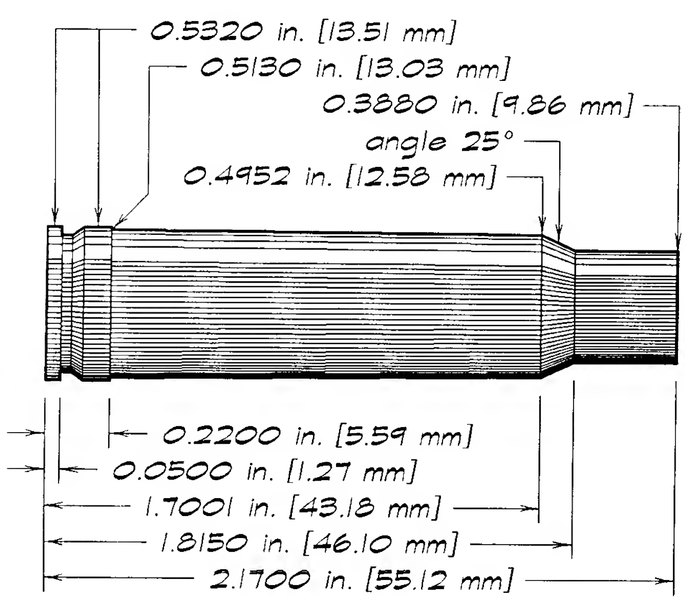


solid:
890 gr brass
104 gr water

.356 bullet displaces
25.17 grains per inch.

Use factory .350 No. 2 brass. Or form from .405 Basic brass, in RCBS form and trim dies.

.350 Remington Magnum (SAAMI maximums)



solid:
886 gr brass
104 gr water

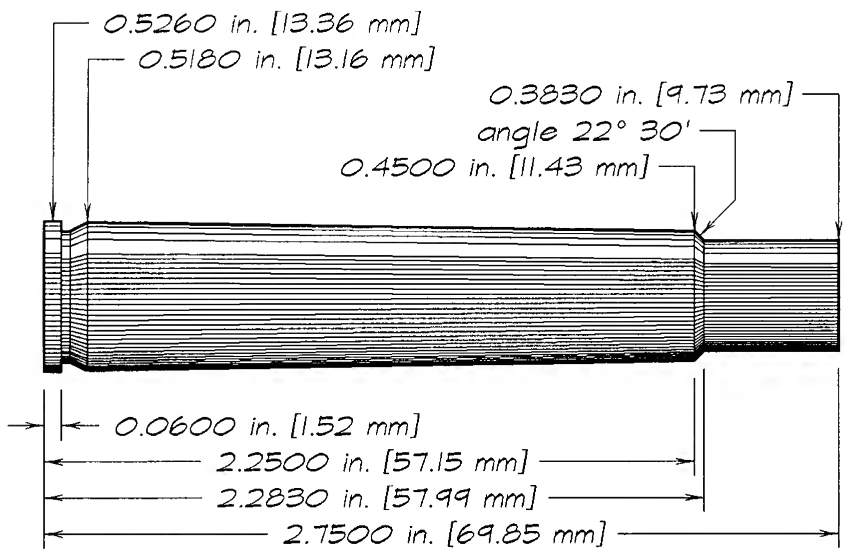
.358 bullet displaces
24.46 grains per inch.

Use factory .350 Remington brass. Or form from 7mm Remington Magnum or .300 Winchester Magnum brass, in RCBS form and trim dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.350 Rigby Magnum (ICI Metals Ltd dwg)

solid:
1,060 gr brass
124 gr water

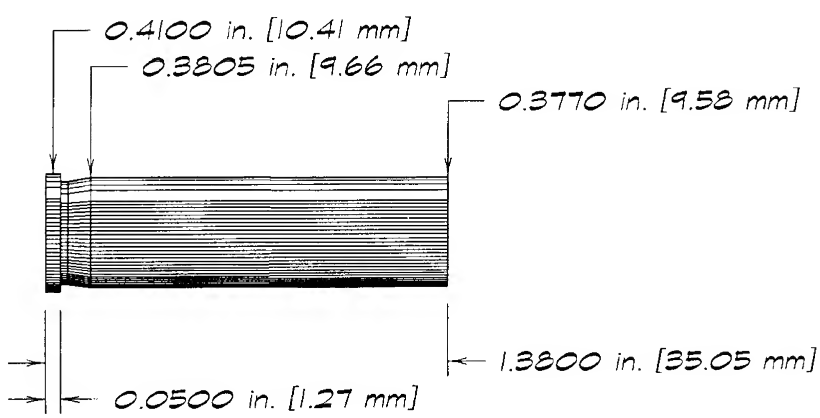


.357 bullet displaces
25.31 grains per inch.

Use recently manufactured .350 Rigby Magnum brass.

.351 Winchester Self-Loading (SAAMI maximums)

solid:
358 gr brass
42 gr water



.351 bullet displaces
24.47 grains per inch.

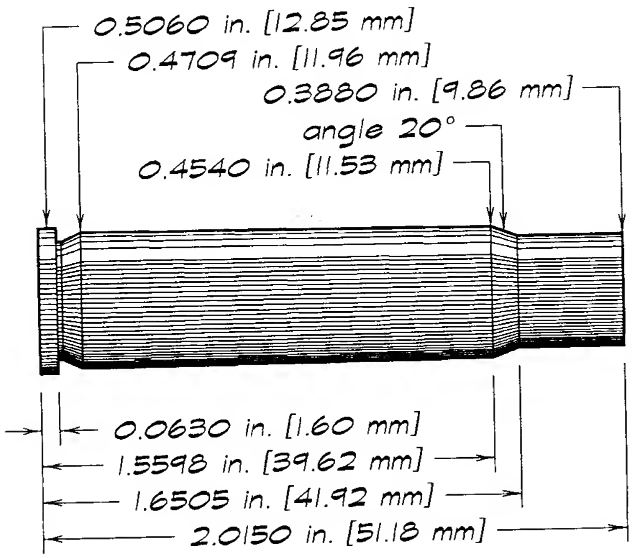
Turn rim of .357 Maximum brass to 0.41 inch. Thin rim (from front) if necessary. Trim.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.356 Winchester

(SAAMI maximums)

solid:
725 gr brass
85 gr water



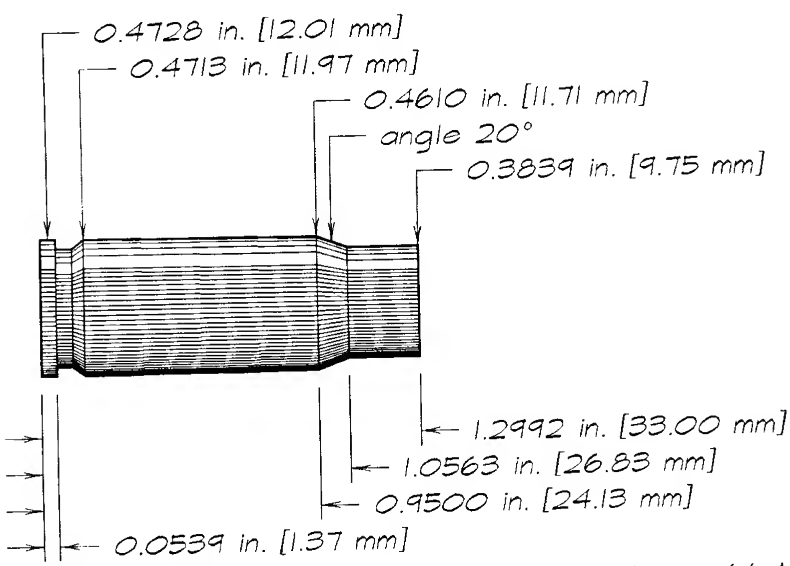
.358 bullet displaces
25.46 grains per inch.

Use factory .356 Winchester brass. Or anneal neck, shoulder, and upper body of .30-06 Springfield brass. Form and trim in RCBS form and trim dies. Ream inside neck, in RCBS neck-ream die. Deburr.

.357 Auto Magnum

(CIP maximums)

solid:
438 gr brass
51 gr water



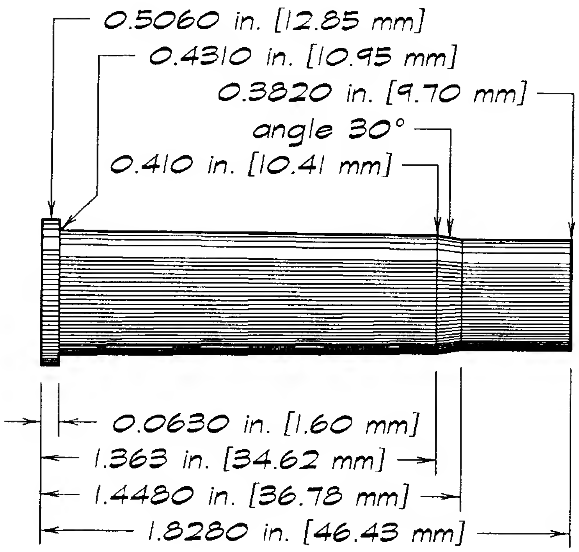
.359 bullet displaces
25.60 grains per inch.

Use factory .357 Auto Mag brass. Or form from .44 Auto Mag brass. Or anneal neck, shoulder, and upper body of .308 Winchester brass and form in RCBS form and trim dies. Trim. Ream inside neck, in RCBS neck-ream die. Deburr.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.357 Herrett (RCBS drawing)

solid:
530 gr brass
62 gr water

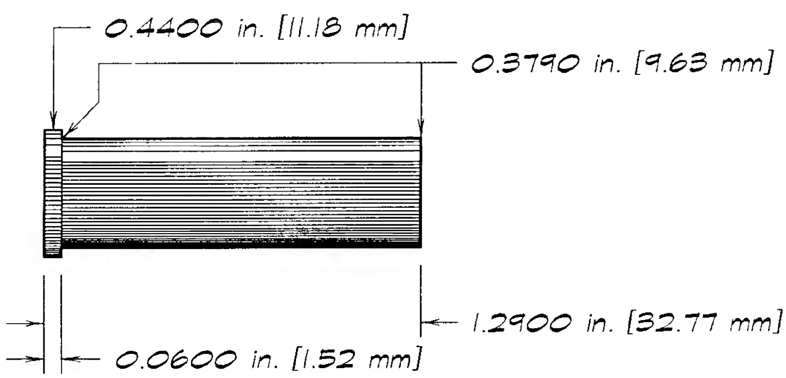


.358 bullet displaces
25.46 grains per inch.

Anneal neck and shoulder of .30-30 Winchester brass. Form and trim in RCBS form and trim dies. Ream inside neck, in RCBS neck-ream die.

.357 Magnum (.357 S&W Magnum) (SAAMI maximums)

solid:
316 gr brass
54 gr water



.358 bullet displaces
25.46 grains per inch.

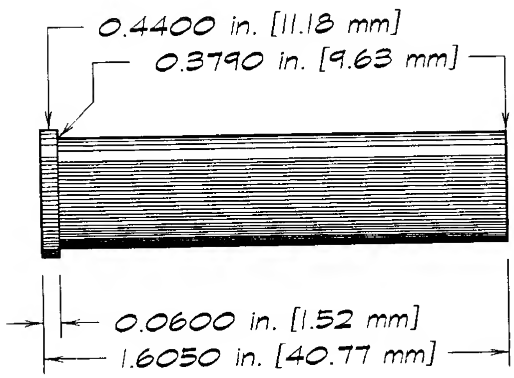
Use factory .357 Magnum brass; there's gobs of it all around. Or trim .357 Remington Maximum brass to 1.29 inch and deburr mouths.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.357 Remington Maximum

(SAAMI maximums)

solid:
392 gr brass
46 gr water



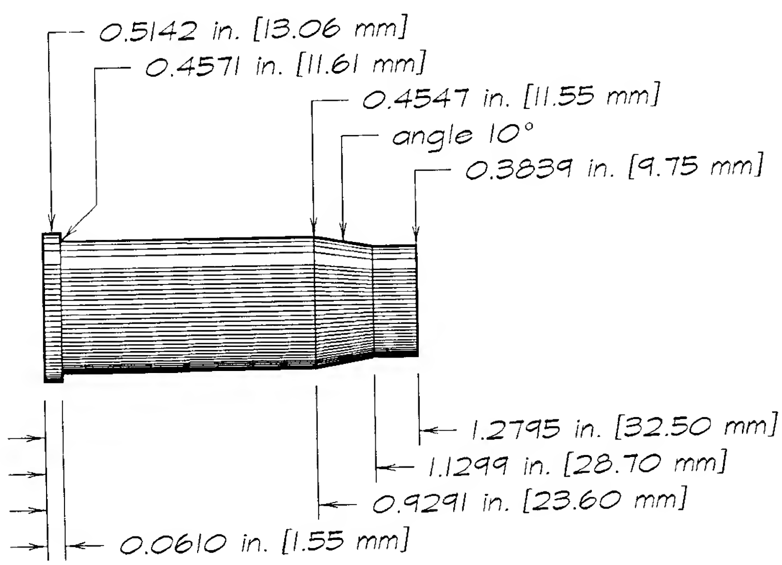
.358 bullet displaces
25.46 grains per inch.

Use factory .357 Maximum brass. No satisfactory substitute is available. Use .357 Magnum brass for .357 Magnum loads only.

.357-.44 Bain & Davis

(Triebel maximums)

solid:
452 gr brass
53 gr water

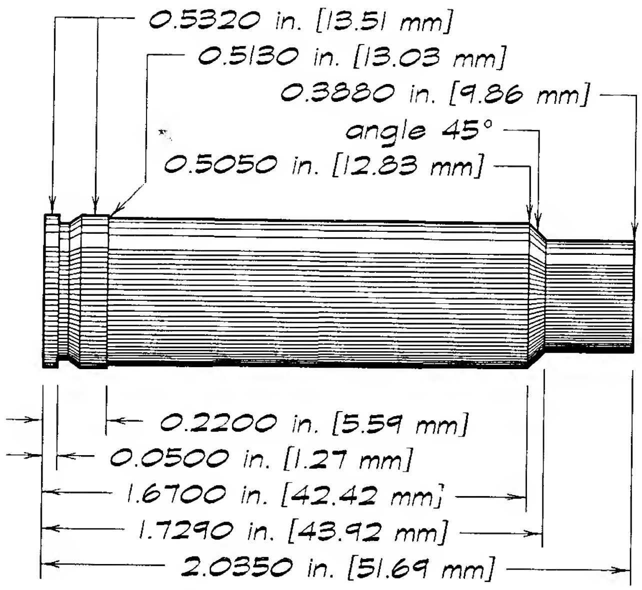


.358 bullet displaces
25.46 grains per inch.

Anneal mouth of .44 Magnum brass and form in RCBS form die. Trim. Deburr.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.358 Davis Short Magnum (designer's specs)

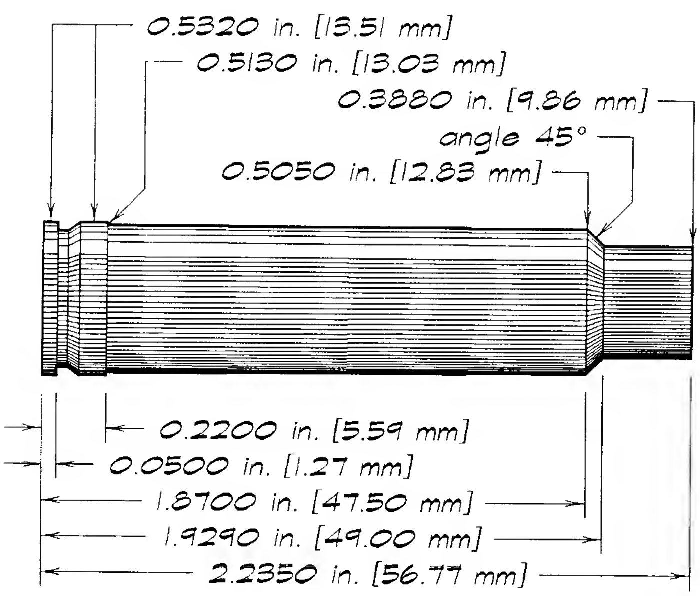


solid:
849 gr brass
100 gr water

.358 bullet displaces
25.46 grains per inch.

Resize .350 Remington Magnum brass full-length in .358 DSM sizer die. Fire-form with inert filler. Trim to 2.035 inches. Deburr.

.358 Davis Short Magnum Number 2 (designer's specs)



solid:
939 gr brass
110 gr water

.358 bullet displaces
25.46 grains per inch.

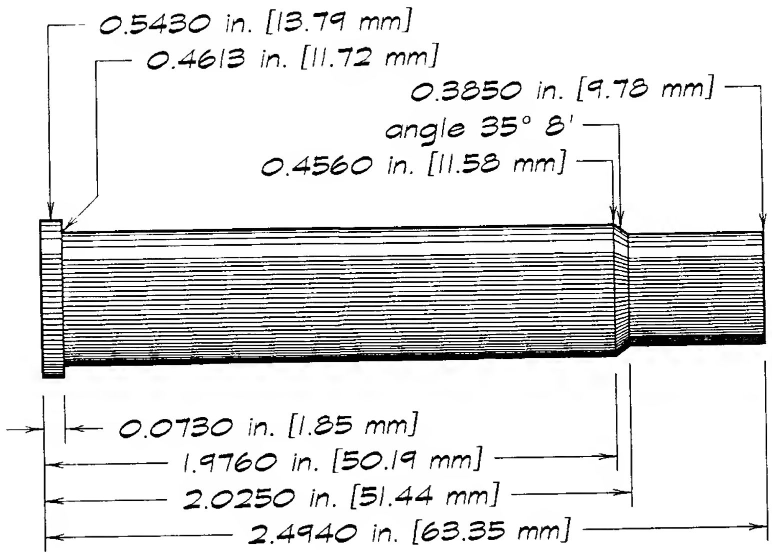
Anneal neck, shoulder, and upper body of .338 Winchester Magnum brass. Resize full-length in .358 DSM No. 2 sizer die. Fire-form with inert filler. Trim to 2.235 inches and deburr.

Anneal only by method shown in text. *Text explains use of "solid" and displacement figures.*

.358 Davis Special Number 2

(designer's specs)

solid:
815 gr brass
96 gr water



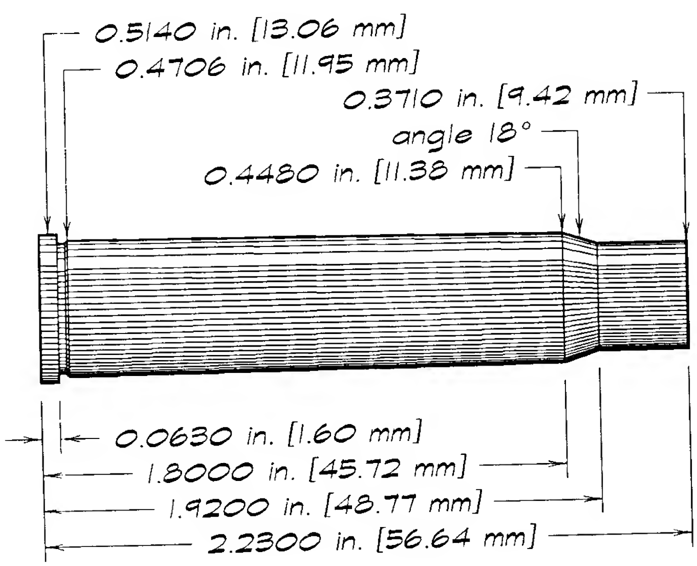
.358 bullet displaces
25.46 grains per inch.

Anneal upper end of .405 Winchester brass (to 1 inch below mouth) and resize full-length in .358 Davis Spl No. 2 sizer die. Fire-form with inert filler. Trim to 2.94 inches and deburr.

.358 JDJ

(JDJ specimen)

solid:
800 gr brass
94 gr water

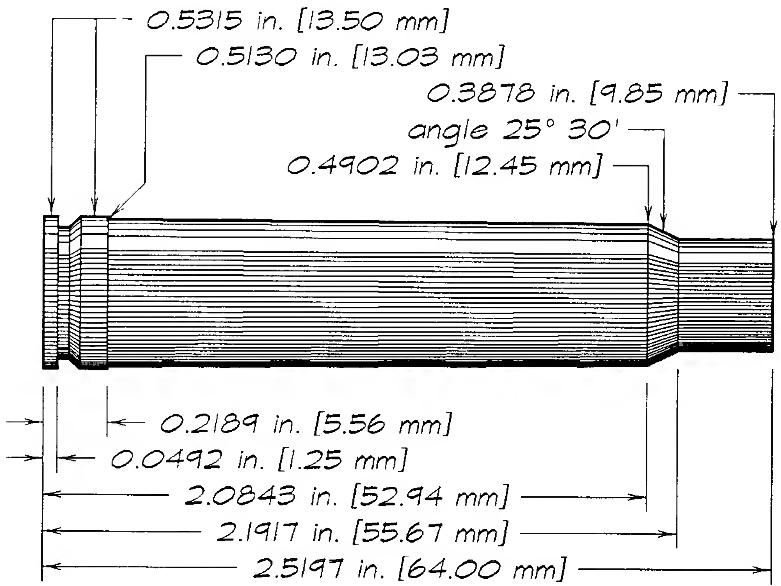


.358 bullet displaces
25.46 grains per inch.

Resize .444 Marlin brass full-length in .358 JDJ sizer die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.358 Norma Magnum (CIP maximums)

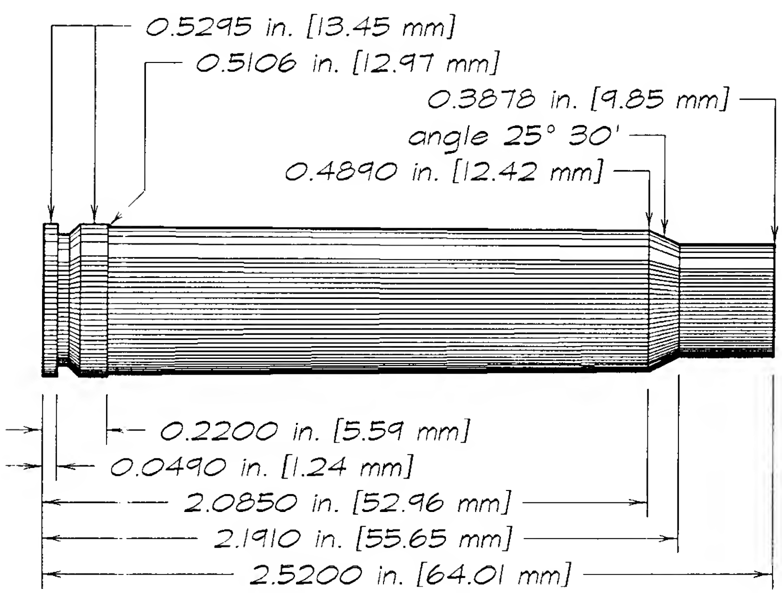


solid:
1,040 gr brass
122 gr water

.359 bullet displaces
25.60 grains per inch.

Use factory .358 Norma Magnum brass. Or anneal neck and shoulder of .300 Winchester Magnum brass and resize full-length in body of .358 Norma Magnum sizer die. Trim to 2.5 inches. Deburr. Fire-form with inert filler.

.358 Norma Magnum (Norma drawing)



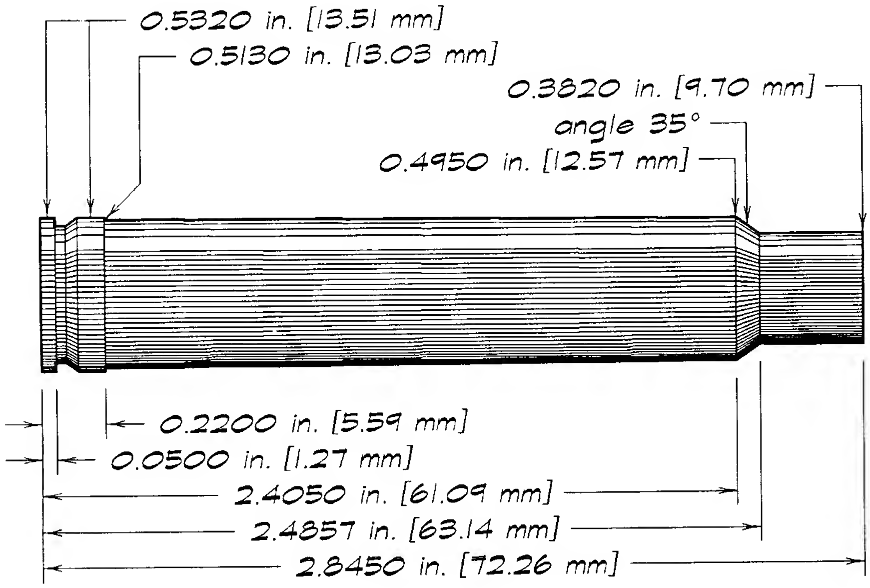
solid:
1,033 gr brass
121 gr water

.358 bullet displaces
25.46 grains per inch.

Use .358 Norma Magnum brass. Or anneal shoulder and upper body of .300 Winchester Magnum brass, trim to 2.53 inches, and resize full-length in body of .358 Norma Magnum sizer die. Trim to 2.5 inches. Deburr. Fire-form with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.358 STA (Layne Simpson specimen)

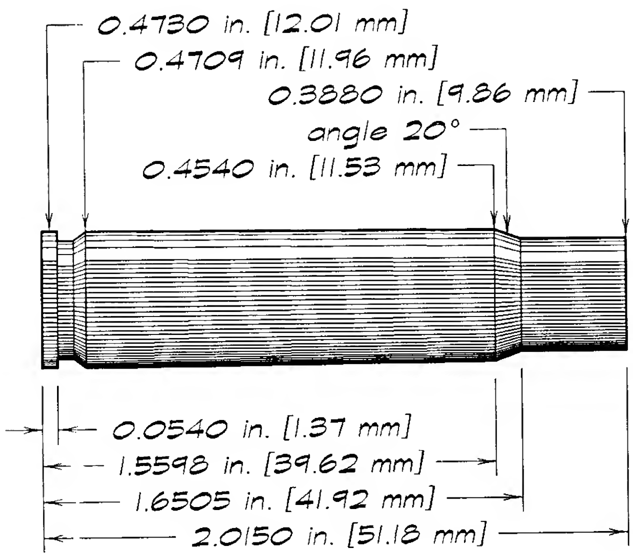


solid:
1,095 gr brass
128 gr water

.358 bullet displaces 25.46 grains per inch.

Resize .416 Remington Magnum brass full-length in .358 STA sizer die. Fire-form with inert filler.

.358 Winchester (SAAMI maximums)



solid:
682 gr brass
80 gr water

.358 bullet displaces 25.46 grains per inch.

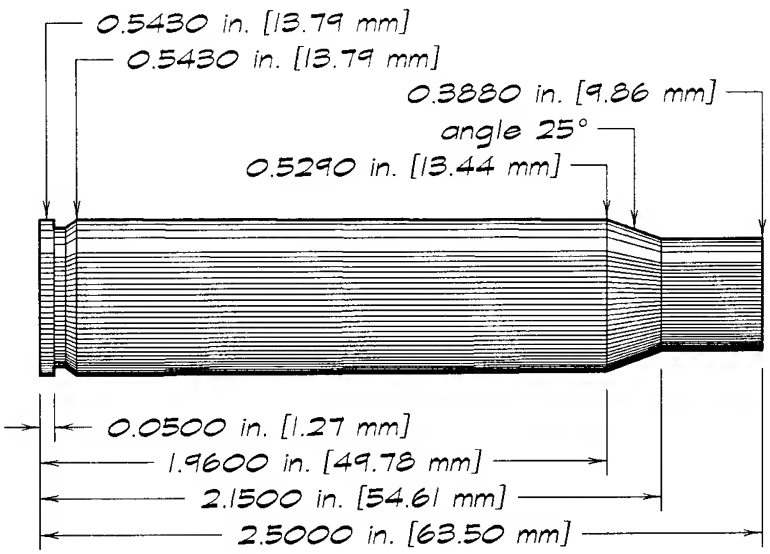
Use factory .358 Winchester brass. Or fire-form the more plentiful .308 Winchester brass (military or commercial) with inert filler. If really desperate, form from .30-06 Springfield brass, in RCBS form die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.358-.404 (Schofield)

(designer's specs)

solid:
1,110 gr brass
130 gr water



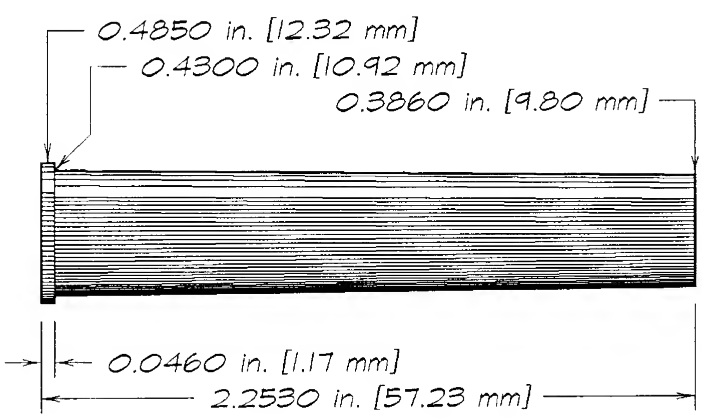
.358 bullet displaces
25.46 grains per inch.

Anneal neck, shoulder, and upper body of .404 Jeffery brass. Form and trim in RCBS form-and-trim dies. Deburr. Fire-form with inert filler.

.360 Express

(Kynoch drawing, 1884)

solid:
647 gr brass
76 gr water



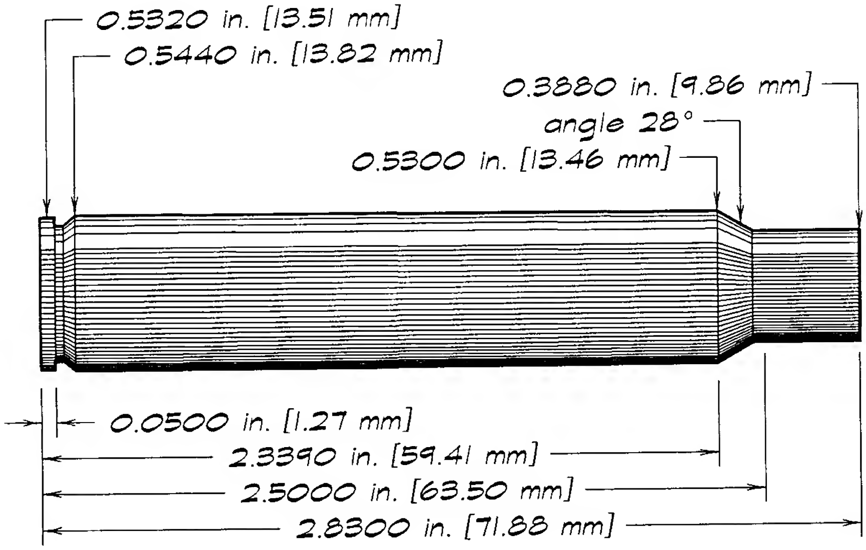
Anneal forward portion of 9.3x72mm Rimmed brass. Form in .360 Express trim die. Ream neck, in RCBS neck-ream die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.360 Imperial Magnum

(Imperial drawing)

solid:
1,273 gr brass
149 gr water



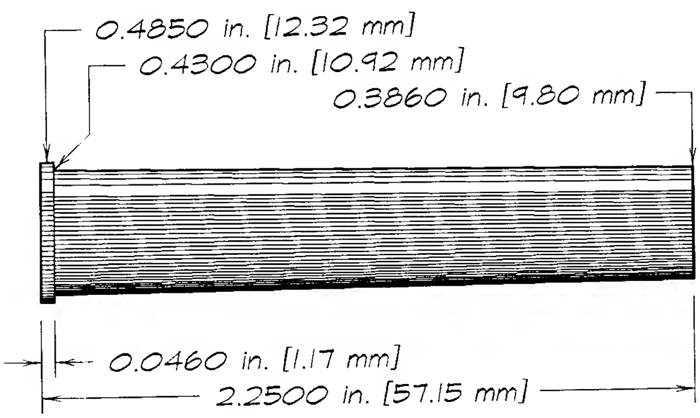
.358 bullet displaces
25.46 grains per inch.

Use .360 Imperial Magnum brass. Or anneal neck and shoulder area of .404 Jeffery Basic brass and form in RCBS .360 Imperial Magnum form and trim dies. Ream inside neck, in RCBS neck-ream die. Deburr.

.360 Nitro Express 2¼-Inch

(Birmingham Proof House)

solid:
646 gr brass
76 gr water



.367 bullet displaces
26.75 grains per inch.

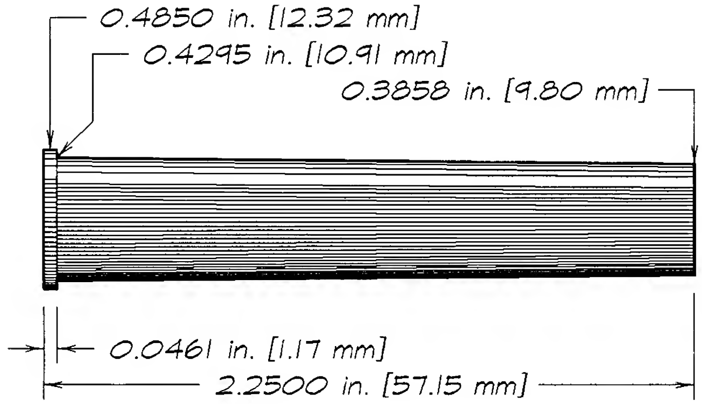
Use factory .360 NE 2¼-Inch brass. Or anneal forward portion of 9.3x72mm Rimmed brass, then form in RCBS form, trim, and ream dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.360 Nitro Express 2¼-Inch

(CIP maximums)

solid:
644 gr brass
76 gr water



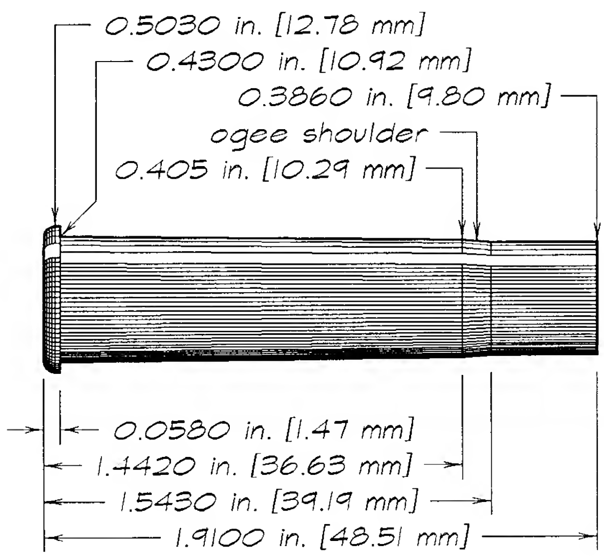
.367 bullet displaces
26.75 grains per inch.

Use factory .360 NE 2¼-Inch brass. Or anneal forward portion of 9.3x72mm Rimmed brass, then form in RCBS form and trim dies.

.360 No. 3 Westley Richards Express

(Kynoch drawing, 1884)

solid:
547 gr brass
64 gr water

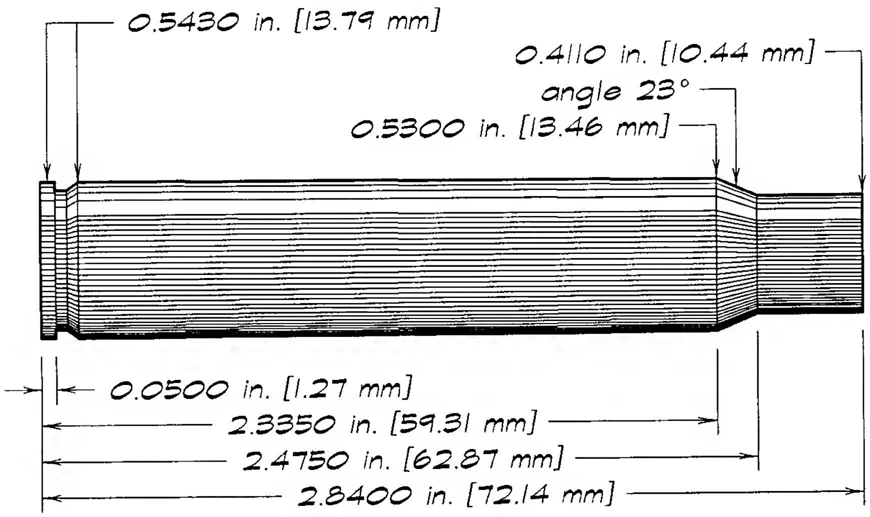


Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.365-.404

(fired case)

solid:
1,292 gr brass
152 gr water



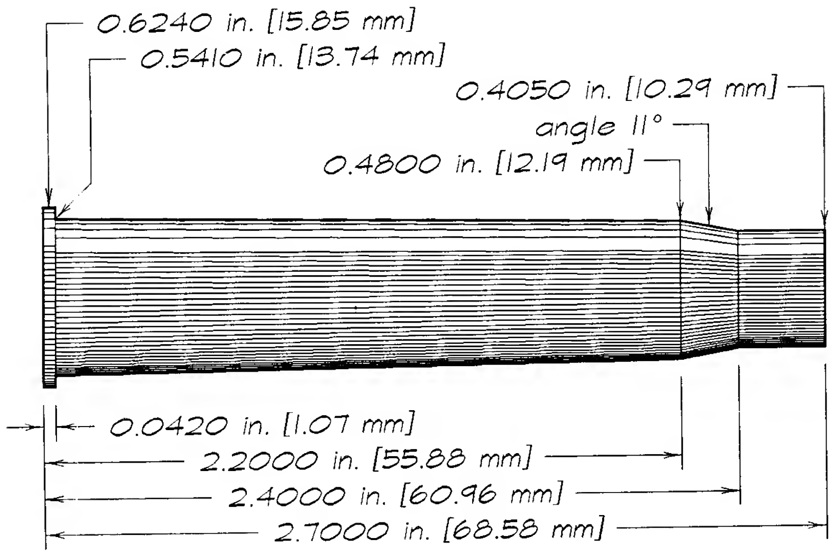
.364 bullet displaces 26.32 grains per inch.

Size .404 Jeffery brass full-length in .364-.404 sizer die. Trim to 2.84 inches and deburr. Fire-form with inert filler.

.369 Nitro Express (Purdey)

(Birmingham Proof House)

solid:
1,122 gr brass
132 gr water

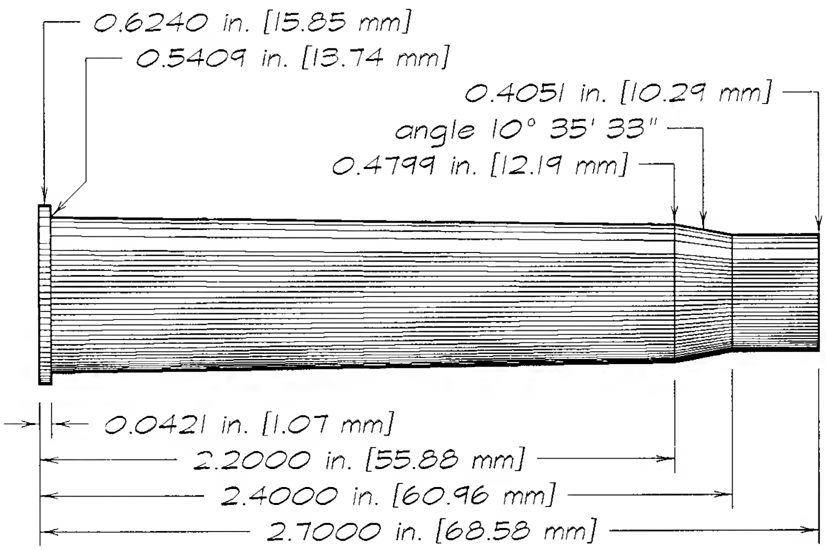


.375 bullet displaces 27.93 grains per inch.

Use factory .369 NE brass. Or form from .450 NE Basic brass, in RCBS form and trim dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.369 Nitro Express Purdey (CIP maximums)

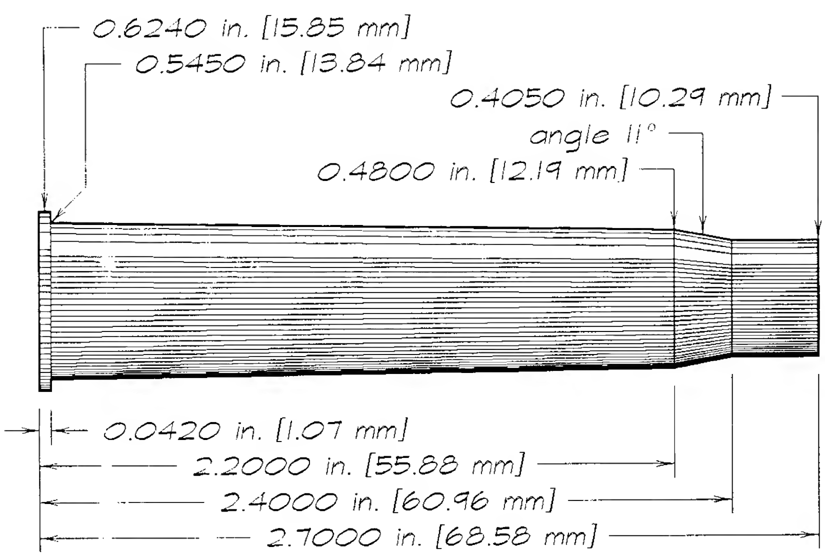


solid:
1,122 gr brass
132 gr water

.375 bullet displaces 27.93 grains per inch.

Use factory .369 NE Purdey brass. Or anneal neck and shoulder area of .450 NE Basic brass and form in RCBS form and trim dies.

.369 Purdey (Kynoch drawing, 1922)



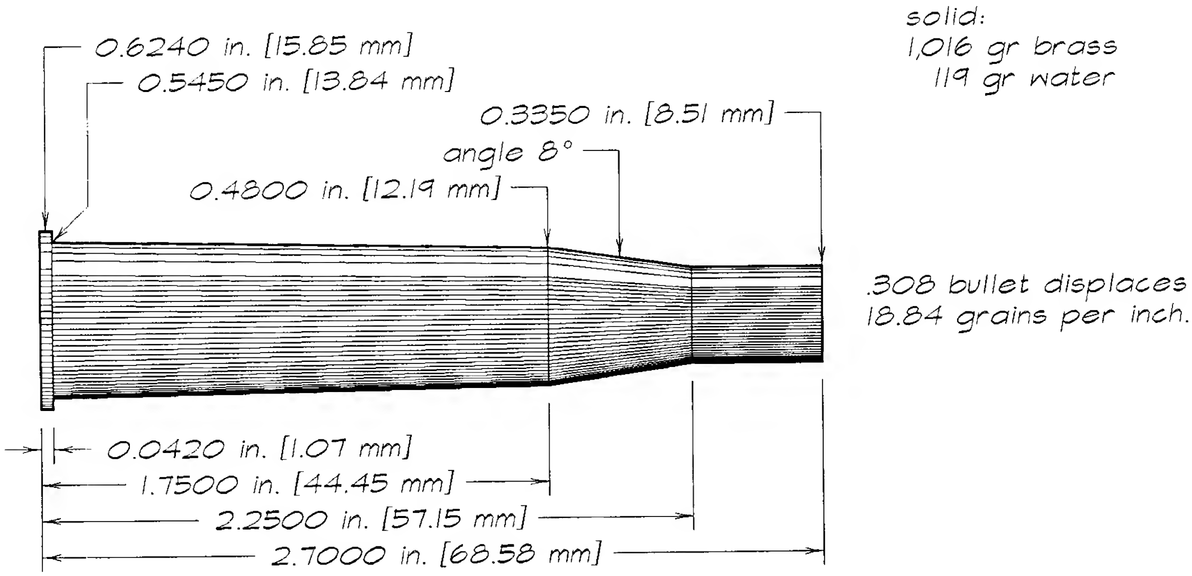
solid:
1,133 gr brass
133 gr water

.375 bullet displaces 27.93 grains per inch.

Use factory .369 NE Purdey brass. Or form from .450 NE Basic brass, in RCBS form and trim dies.

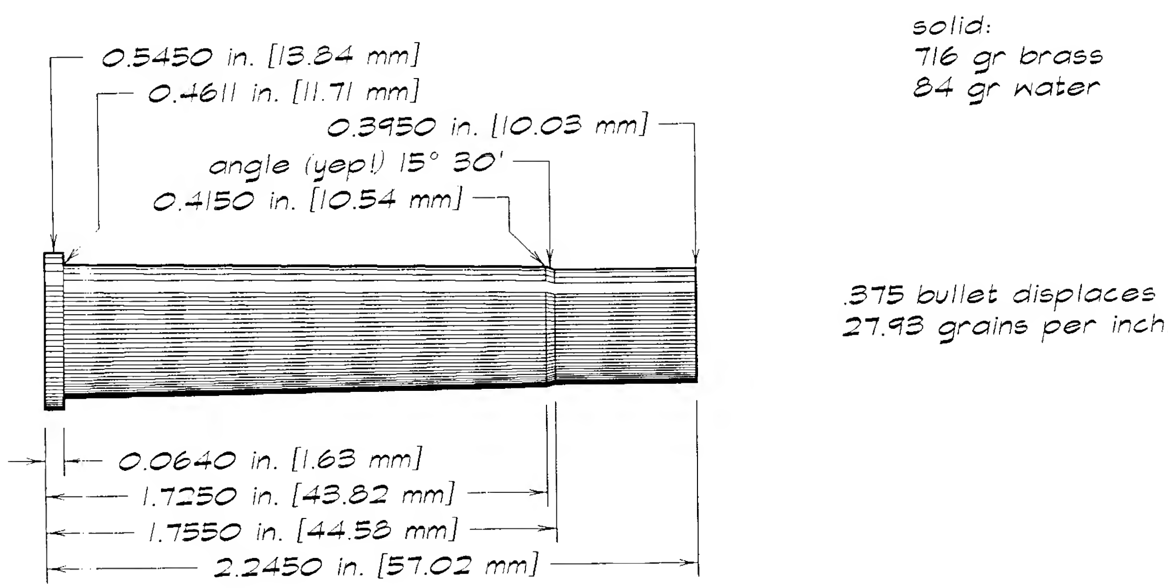
Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.369-.30 Purdey (Kynoch drawing, 1936)



Form from .369 NE Purdey brass, or from .450 NE Basic brass, in RCBS form and trim dies.

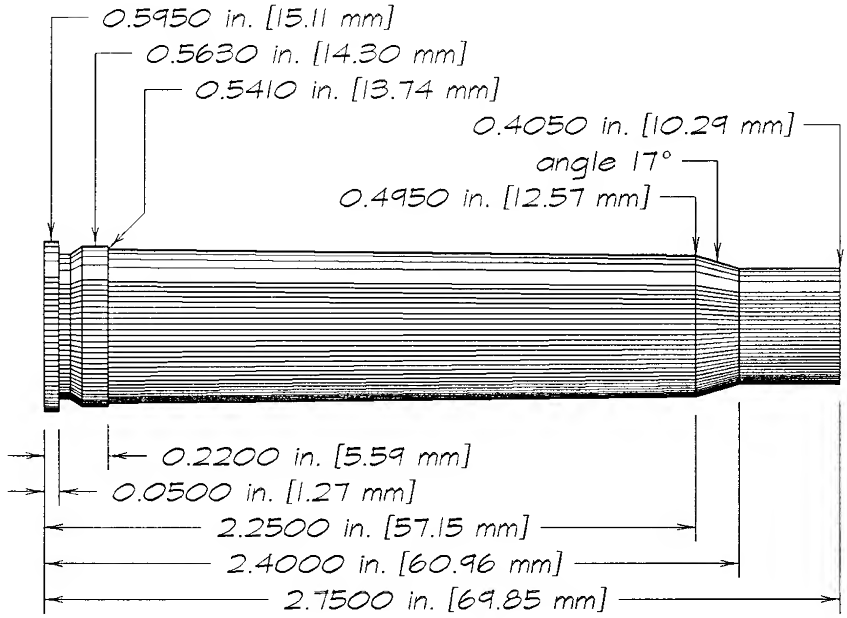
.37 Rimmed (.375 Krag) (David J LeGate)



Anneal neck and shoulder of .30-40 Krag brass and fire-form with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

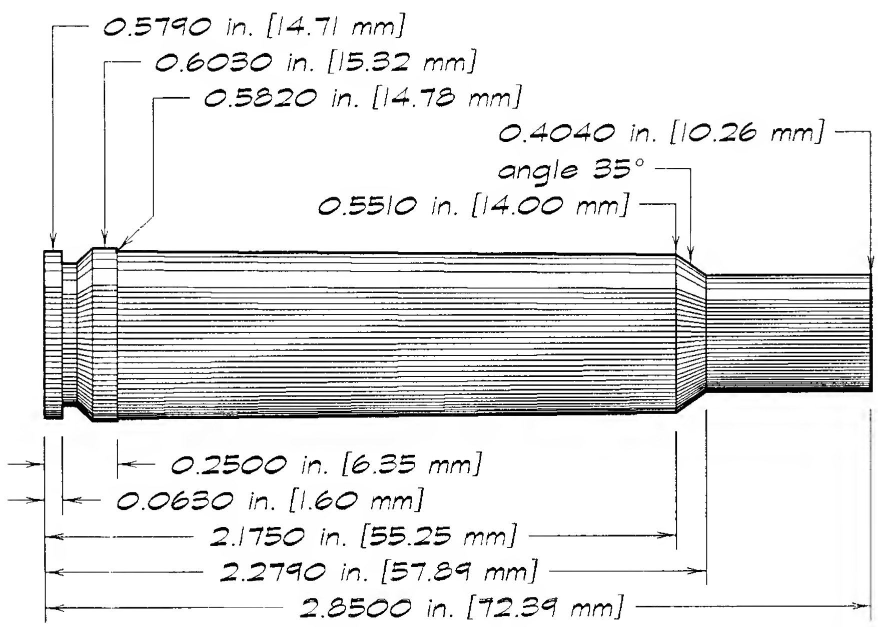
.370 Cogswell & Harrison (Kynoch drawing, 1921)



solid:
1,203 gr brass
141 gr water

.375 bullet displaces
27.93 grains per inch.

.375 A-Square (A-Square maximums)



solid:
1,400 gr brass
164 gr water

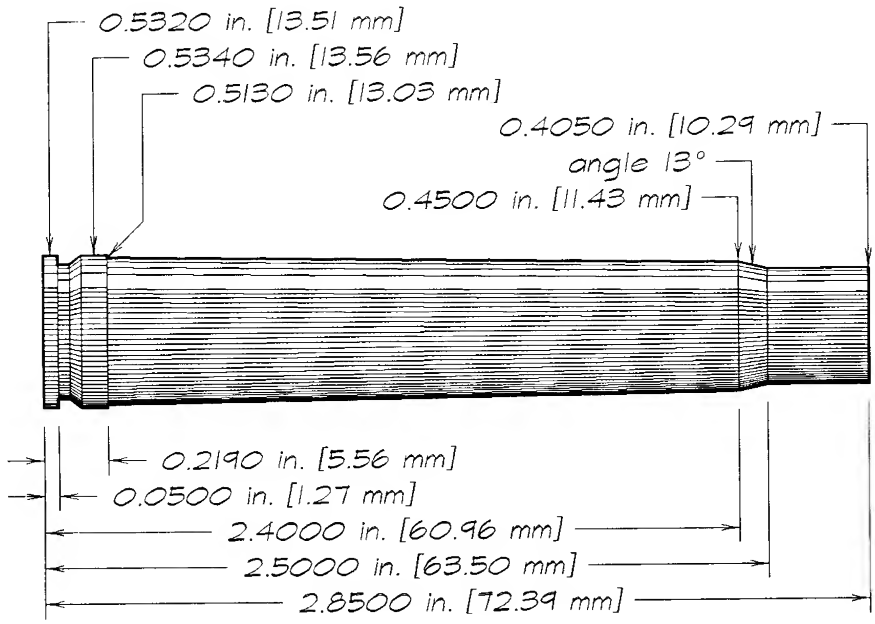
.375 bullet displaces
27.93 grains per inch.

Use A-Square or A-Cube factory brass. Or anneal neck and shoulder of .378 or .460 Weatherby Magnum brass and form in RCBS form and trim dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.375 Belted Rimless Magnum Nitro Express (Birmingham Proof House)

solid:
1,127 gr brass
132 gr water

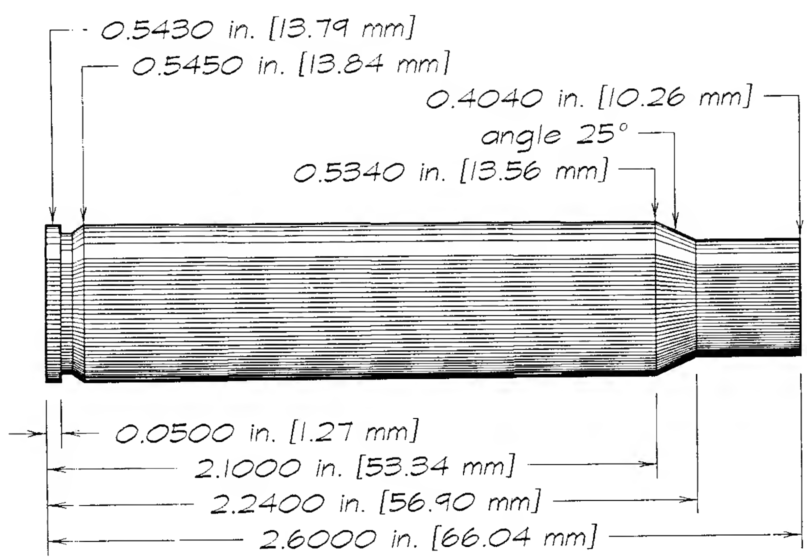


.375 bullet displaces 27.93 grains per inch.

Use factory .375 H&H Magnum brass. Or anneal neck and shoulder of .300 H&H Magnum brass and fire-form with inert filler.

.375 Breeding (designers' specs)

solid:
1,180 gr brass
138 gr water



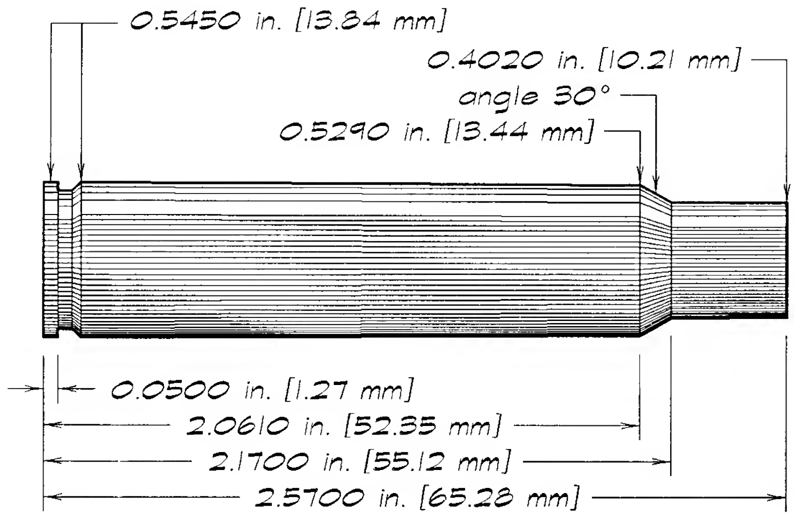
.375 bullet displaces 27.93 grains per inch.

Anneal neck, shoulder, and upper body of RWS .404 Jeffery brass and form in RCBS form and trim dies. Ream inside neck, in RCBS neck-ream die. Deburr.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.375 Dakota (Dakota Arms drawing)

solid:
1,148 gr brass
135 gr water

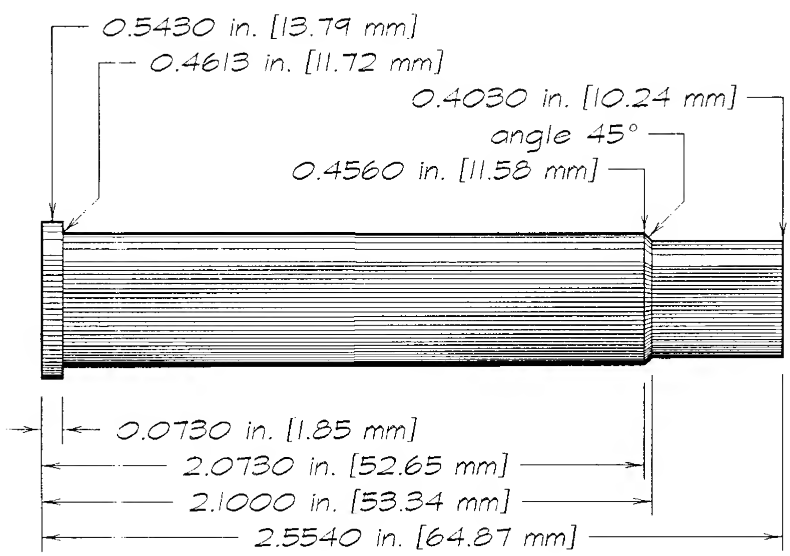


.375 bullet displaces 27.93 grains per inch.

Anneal neck and shoulder of .404 Jeffery brass and form in RCBS form and trim dies. Deburr. Fire-form with inert filler.

.375 Davis Special Number 2 (designer's specs)

solid:
856 gr brass
100 gr water



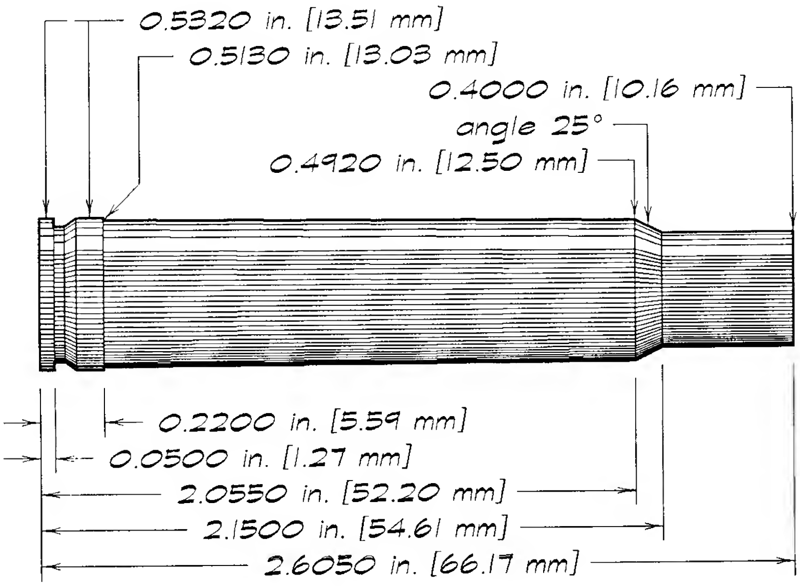
.375 bullet displaces 27.93 grains per inch.

Anneal upper ½ inch of .405 Winchester brass and resize full-length in .375 Davis Spl No. 2 sizer die. Trim and deburr.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.375 Epstein (David J LeGate)

solid:
1,075 gr brass
126 gr water

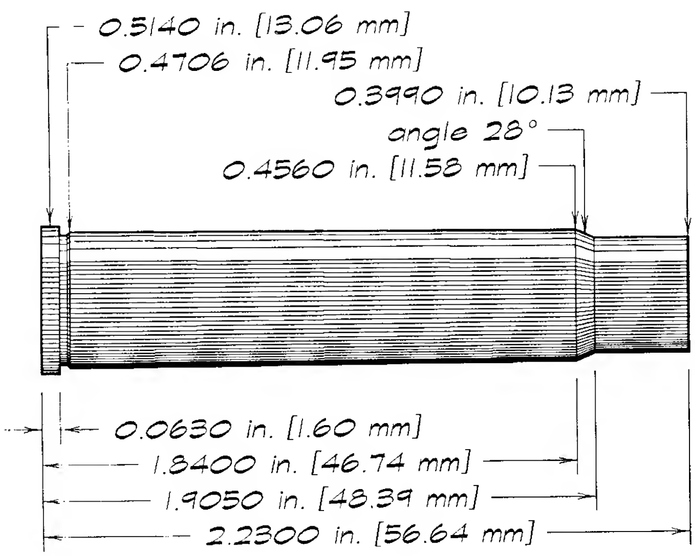


.375 bullet displaces 27.93 grains per inch.

Form from .300 H&H Magnum or .375 H&H Magnum brass, in RCBS form and trim dies. Deburr mouths.

.375 Express [Waters] (Ken Waters)

solid:
831 gr brass
98 gr water

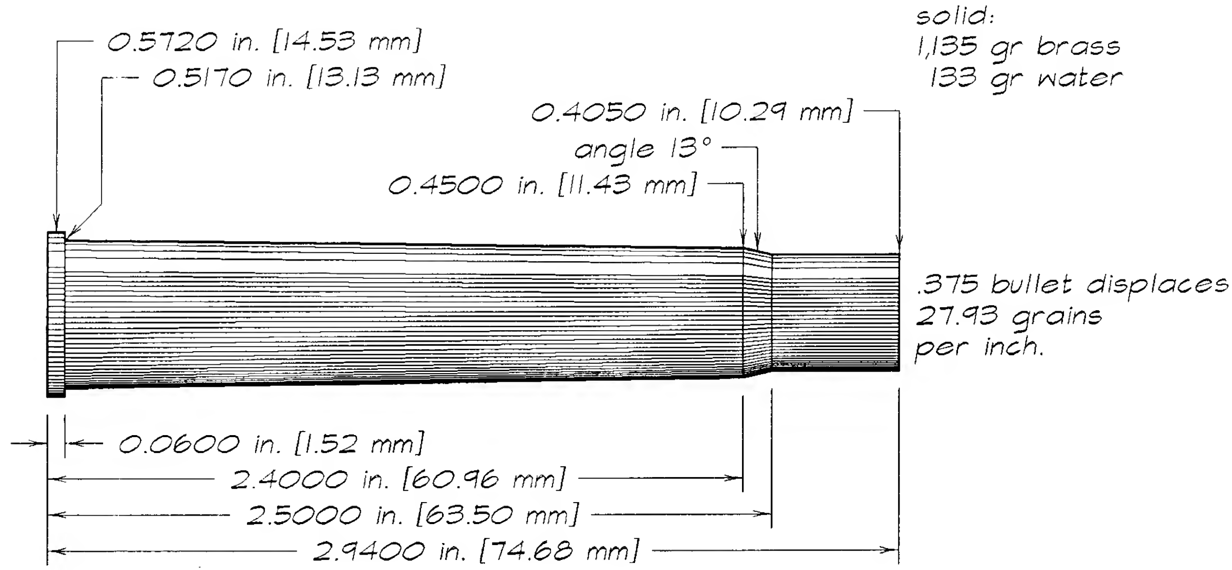


.375 bullet displaces 27.93 grains per inch.

Resize ~~.444~~ Marlin brass full-length in .375 Express sizer die.

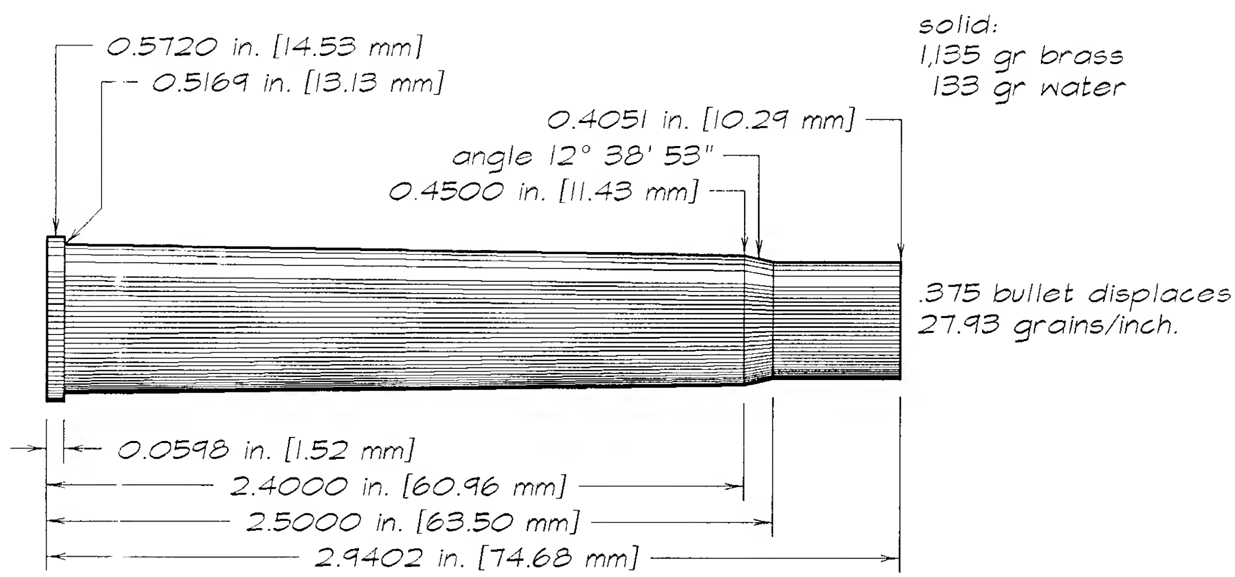
Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.375 Flanged Magnum Nitro Express (Birmingham Proof House)



Use factory .375 Flanged Magnum NE brass. Or form from .375 Flanged Basic brass, in RCBS form-and-trim die.

.375 Flanged Magnum Nitro Express (CIP maximums)

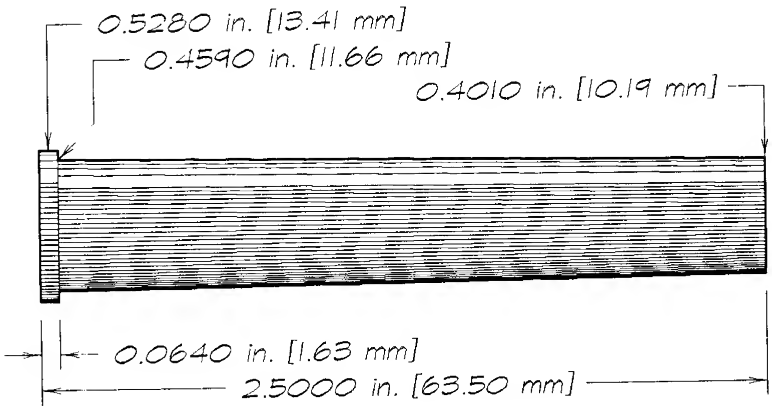


Use factory .375 Flanged Magnum NE brass. Or form from .375 Flanged Basic brass, in RCBS form-and-trim die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.375 Flanged Nitro Express 2½-Inch (Birmingham Proof House)

solid:
798 gr brass
94 gr water

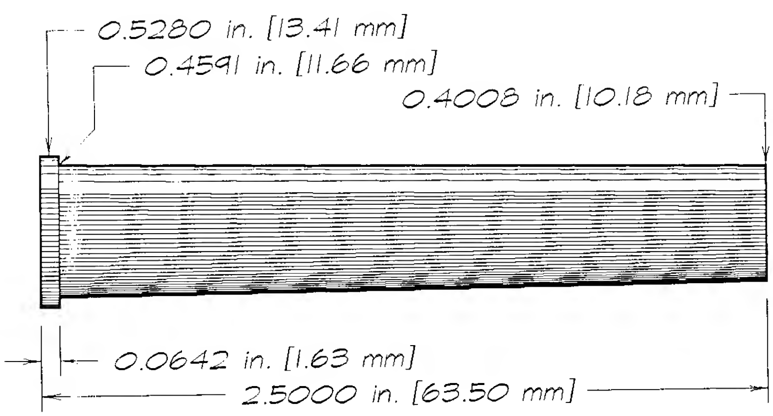


.375 bullet displaces 27.93 grains per inch.

Use factory .375 Flanged NE 2½-Inch brass. Or form from 9.3x74mm Rimmed brass, in RCBS form and trim dies.

.375 Flanged Nitro Express 2½-Inch (CIP maximums)

solid:
798 gr brass
94 gr water

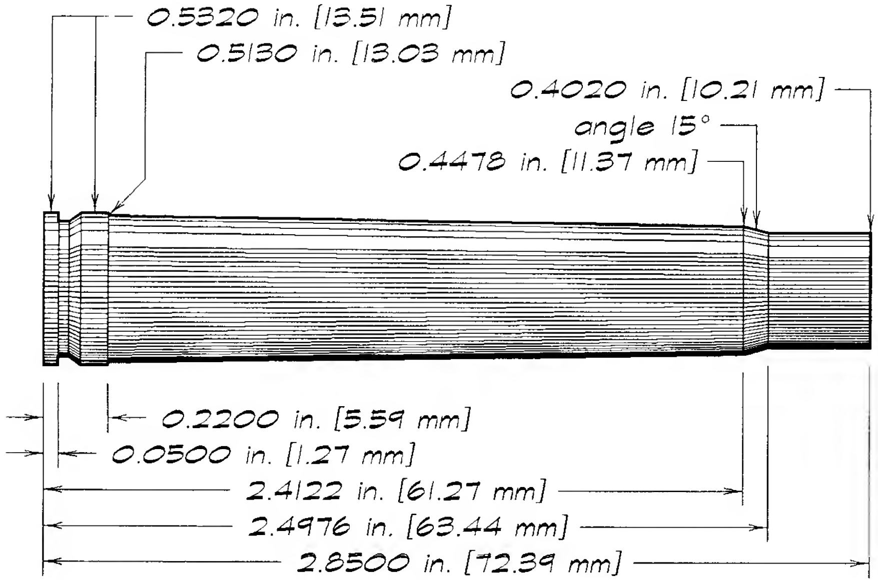


.375 bullet displaces 27.93 grains per inch.

Use factory .375 Flanged NE 2½-Inch brass. Or form from 9.3x74mm Rimmed brass, in RCBS form and trim dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.375 H&H Magnum (SAAMI maximums)

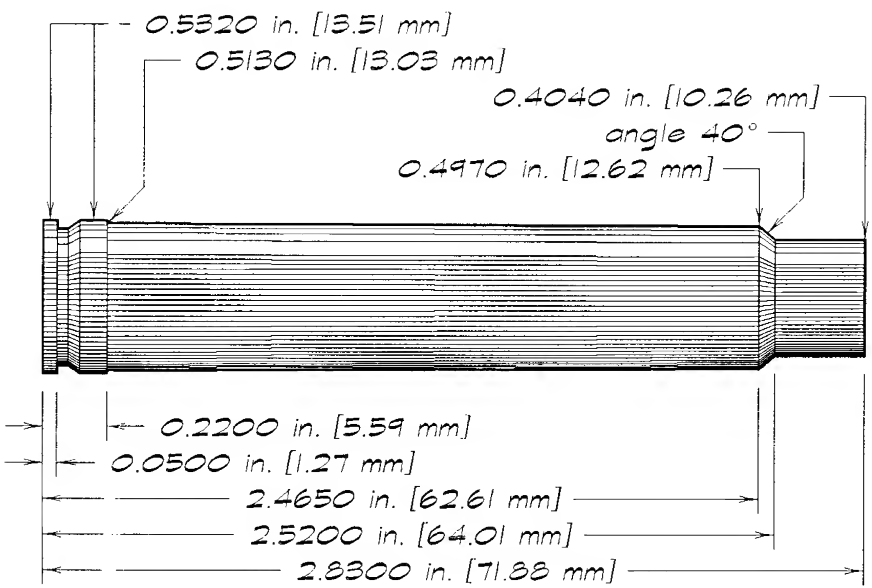


solid:
1,121 gr brass
132 gr water

.375 bullet displaces 27.93 grains per inch.

Use factory .375 H&H Magnum brass. Or anneal neck, shoulder, and upper body of .300 H&H Magnum brass and fire-form with inert filler.

.375 H&H Magnum Improved (David J LeGate)



solid:
1,204 gr brass
141 gr water

.375 bullet displaces 27.93 grains per inch.

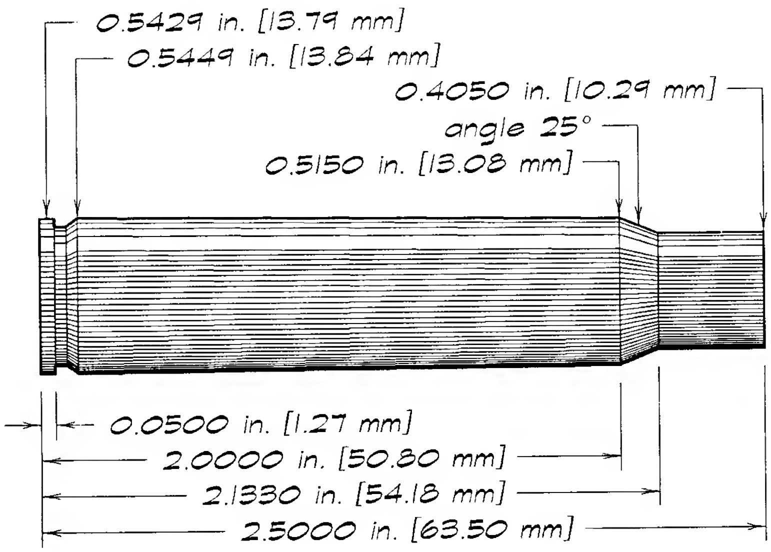
Fire-form .375 H&H Magnum loads in .375 H&H Magnum Improved chamber. Or fire-form .375 H&H Magnum brass with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.375 Howell

(designer's specs)

solid:
1,114 gr brass
131 gr water



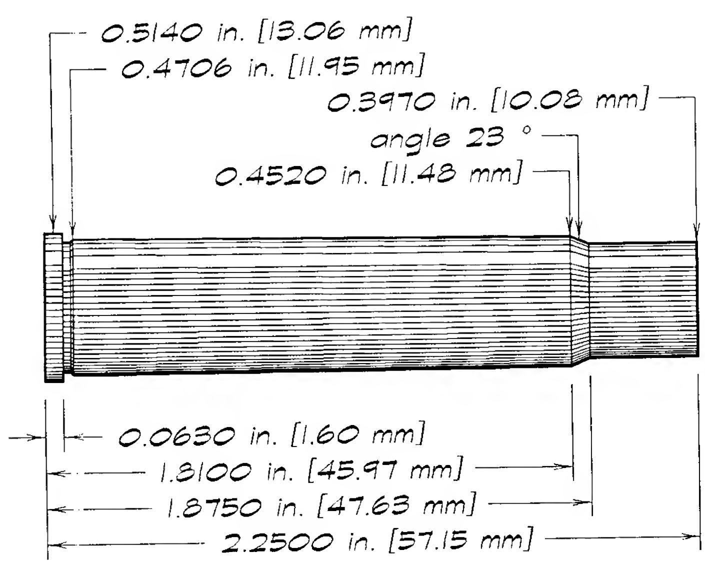
.375 bullet displaces 27.93 grains per inch.

Form from .404 Jeffery brass, in RCBS form-and-trim die. Ream inside neck with RCBS neck-ream set. Fire-form with inert filler.

.375 JDJ

(JDJ specimen)

solid:
762 gr brass
89 gr water



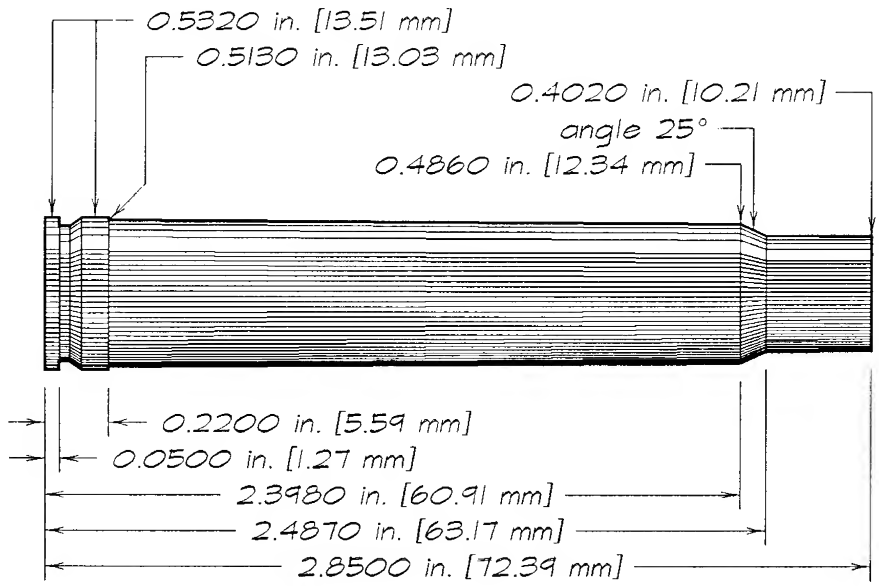
.375 bullet displaces 27.93 grains per inch.

Resize .444 Marlin brass full-length in .375 JDJ sizer die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.375 JRS (A-Square maximums.)

solid:
1,194 gr brass
140 gr water

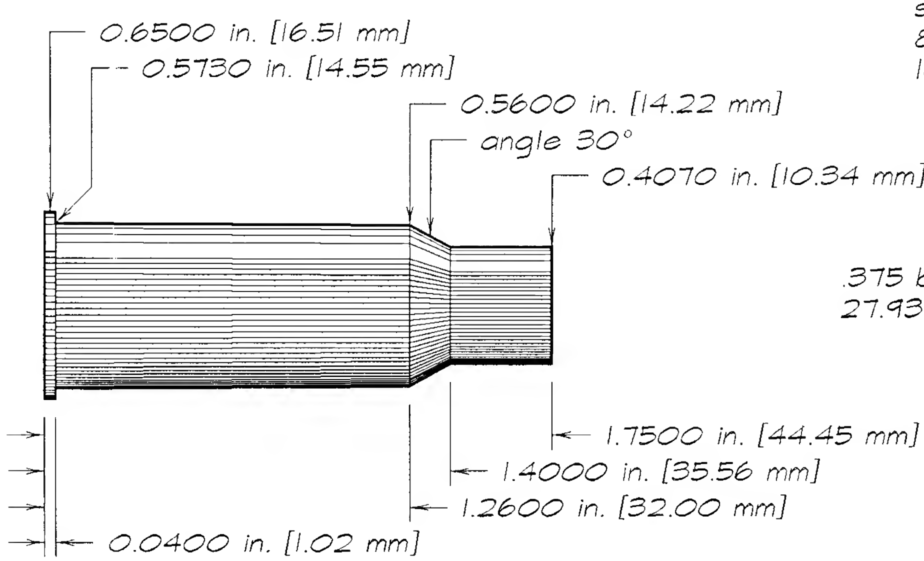


.375 bullet displaces
27.93 grains per inch.

Use A-Square or A-Cube factory brass. Or resize 8mm Remington Magnum brass full-length in .375 JRS sizer die, then fire-form with inert filler.

.375 Jurras (Jurras drawing)

solid:
873 gr brass
102 gr water

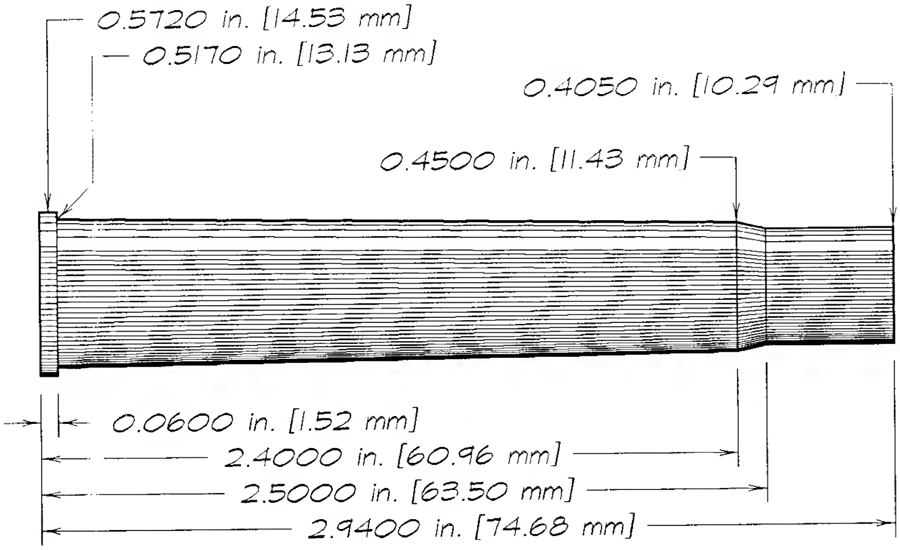


.375 bullet displaces
27.93 grains per inch.

Anneal upper body of .500 Nitro Express brass. Form and trim in RCBS form-and-trim die. Ream inside neck, in RCBS neck-ream die. Fire-form with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.375 Magnum Flanged (ICI Metals Ltd dwg)

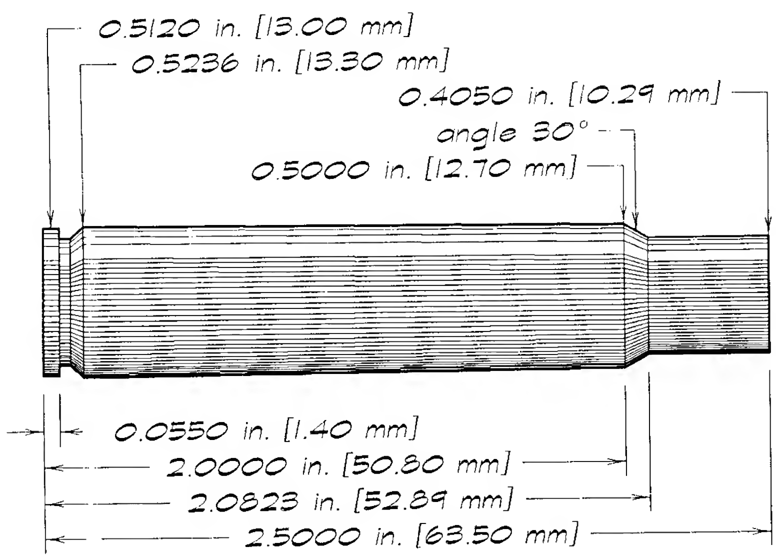


solid:
1,135 gr brass
133 gr water

.375 bullet displaces 27.93 grains per inch.

Use factory .375 Flanged Magnum brass. Or form from .375 Flanged Basic brass, in RCBS form-and-trim die.

.375 Number 2 Howell (designer's specs)



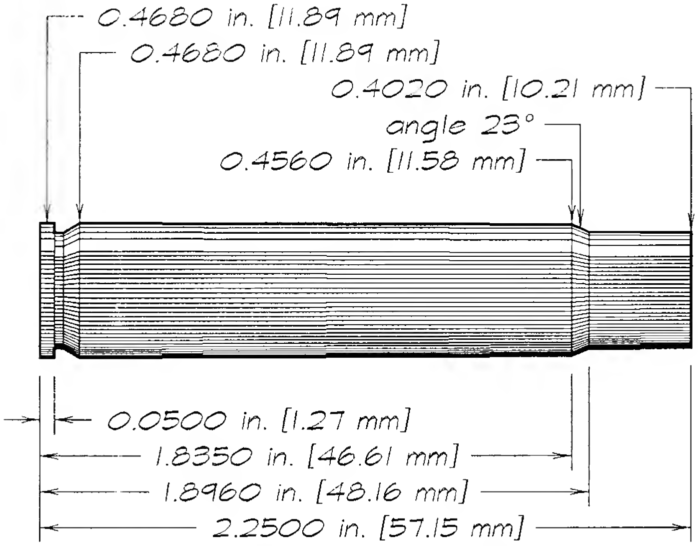
solid:
949 gr brass
111 gr water

.375 bullet displaces 27.93 grains per inch.

Anneal neck and shoulder of 8x68mm S Magnum brass. Trim to 2.6 inches. Fire-form with inert filler. Trim to 2.5 inches. Ream inside neck if necessary. Deburr.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.375 Rimless (9.5mm Mannlicher Schoenauer) (ICI Metals Ltd dwg)

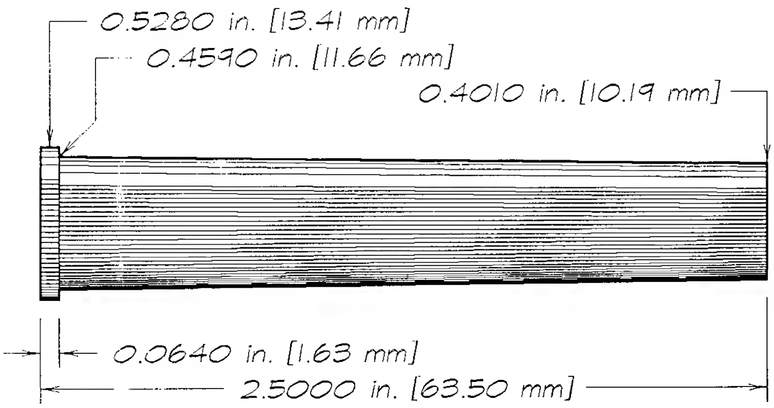


solid:
773 gr brass
91 gr water

.375 bullet displaces
27.93 grains per inch.

Anneal neck and shoulder of .35 Whelen brass and resize full-length in body of .375 Rimless sizer die (with decapper-expander removed) or RCBS form-and-trim die. Trim to 2.25 inches. Fire-form with inert filler.

.375 Straight-Taper Express (ICI Metals Ltd dwg)



solid:
798 gr brass
94 gr water

.375 bullet displaces
27.93 grains per inch.

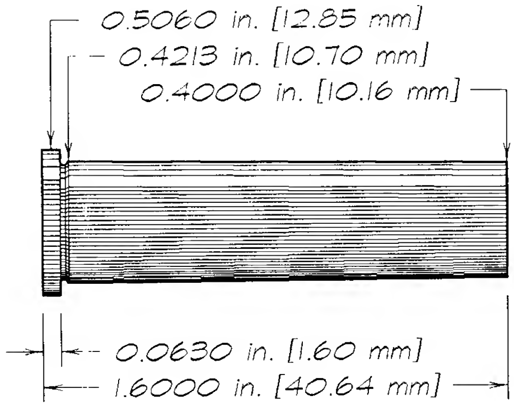
Form from .405 Basic brass, in RCBS form and trim dies. Ream neck, in RCBS neack-ream die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.375 Super Mag

(Elgin T Gates drawing)

solid:
470 gr brass
55 gr water



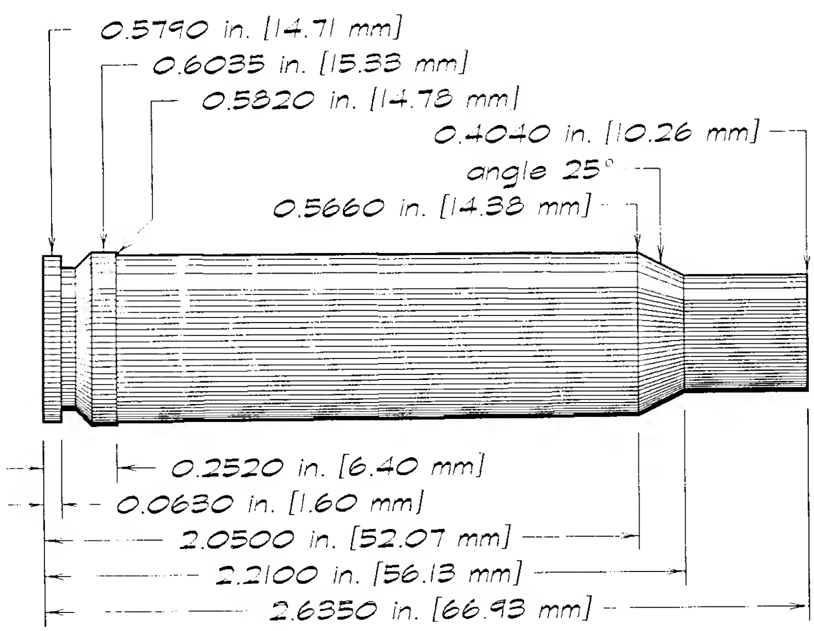
.375 bullet displaces
27.93 grains per inch.

Trim .375 Winchester brass to 1.6 inches and deburr.

.375 Von Horn

(David J LeGate)

solid:
1,330 gr brass
156 gr water

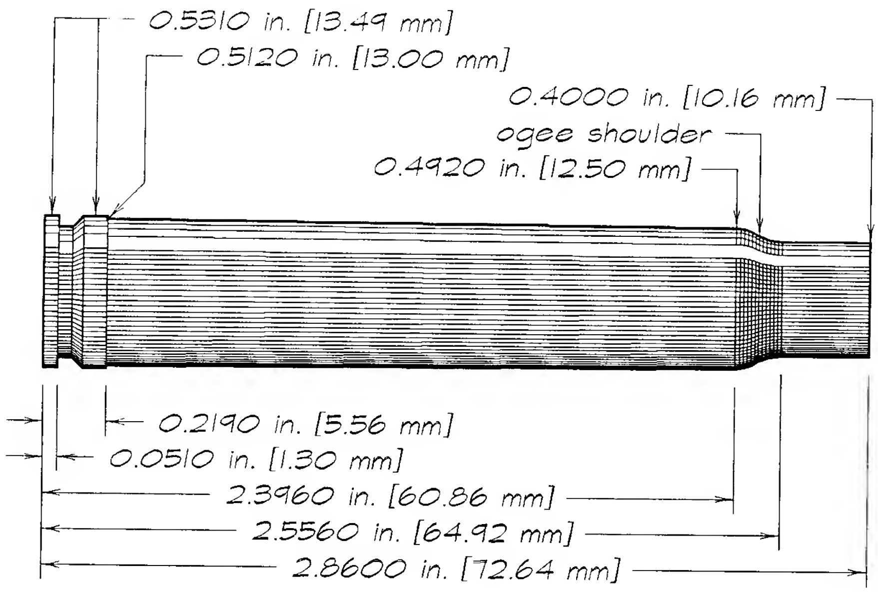


.375 bullet displaces
27.93 grains per inch.

Anneal neck and shoulder of .378 or .460 Weatherby Magnum brass. Form and trim in RCBS form and trim dies. Ream inside neck. Deburr mouth.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.375 Weatherby Magnum (Weatherby's maximums)

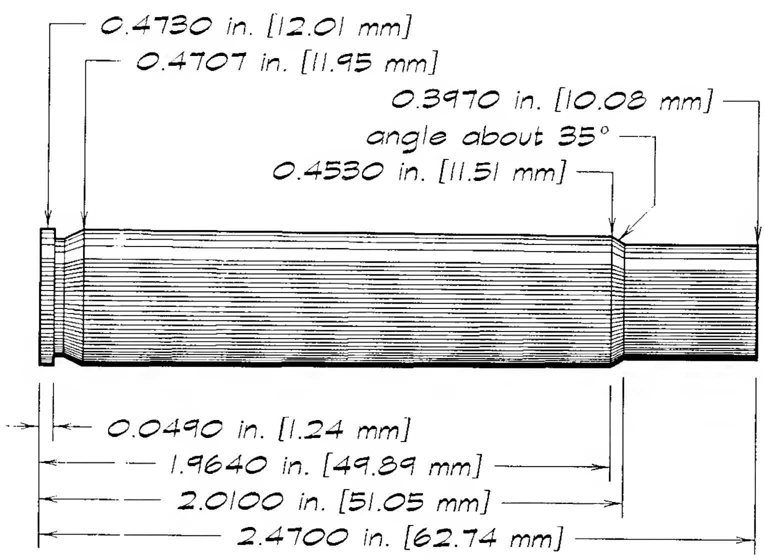


solid:
1,198 gr brass
140 gr water

.375 bullet displaces
27.93 grains per inch.

Fire .375 H&H Magnum ammunition, or fire-form .375 H&H Magnum brass with inert filler. Or anneal neck and shoulder of .300 H&H or Weatherby Magnum brass and fire-form with inert filler.

.375 Whelen Improved (SAAMI, Dave LeGate)



solid:
839 gr brass
98 gr water

.375 bullet displaces
27.93 grains per inch.

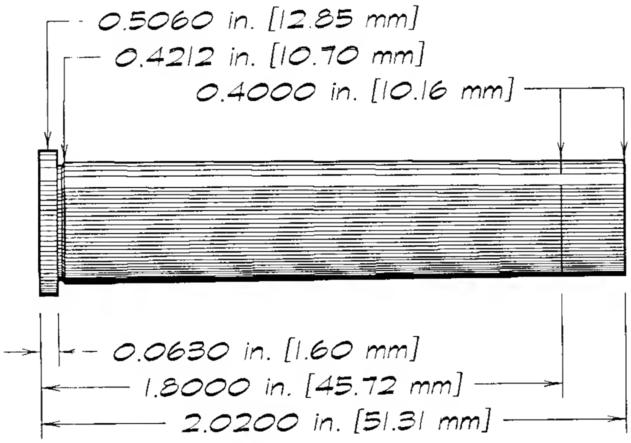
Anneal neck and shoulder of .35 Whelen or .30-06 case. Fire-form with inert filler. Fire-formed shoulder may be rounded but will form to full dimensions with a moderate to heavy load.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.375 Winchester

(SAAMI maximums)

solid:
591 gr brass
69 gr water



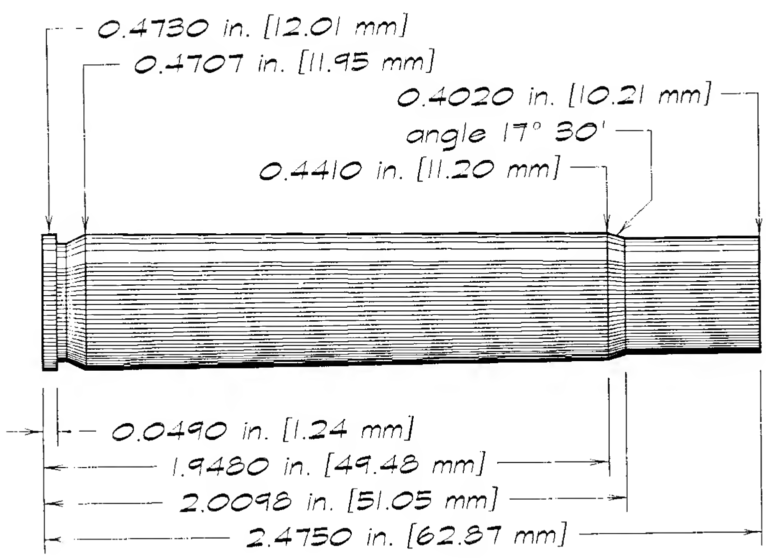
.375 bullet displaces 27.93 grains per inch.

Use factory .375 Winchester brass. Or trim .38-55 Winchester brass to .375 Winchester length and deburr mouth. Or fire-form .30-30 Winchester brass with inert filler, trim to length, and deburr.

.375-06

(designer's specs)

solid:
770 gr brass
90 gr water

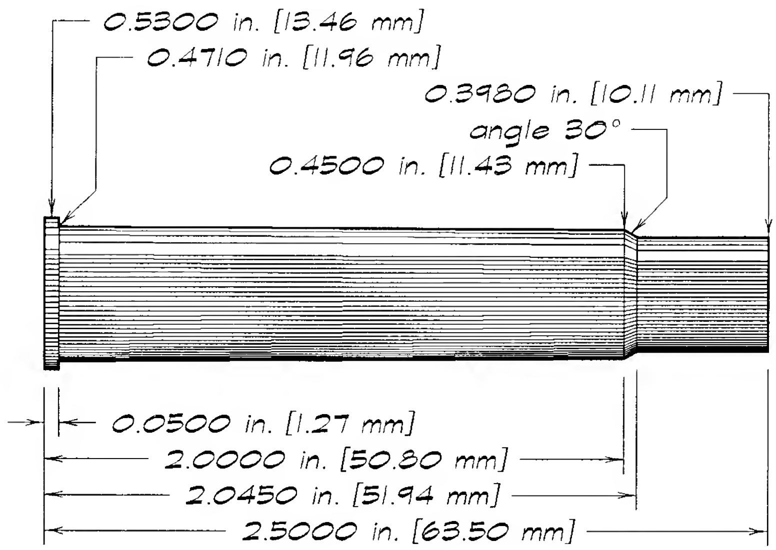


.375 bullet displaces 27.93 grains per inch.

Fire-form .35 Whelen brass with inert filler. Or anneal neck and shoulder of .30-06 Springfield brass and fire-form with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.375-06 Rimmed (designer's specs)

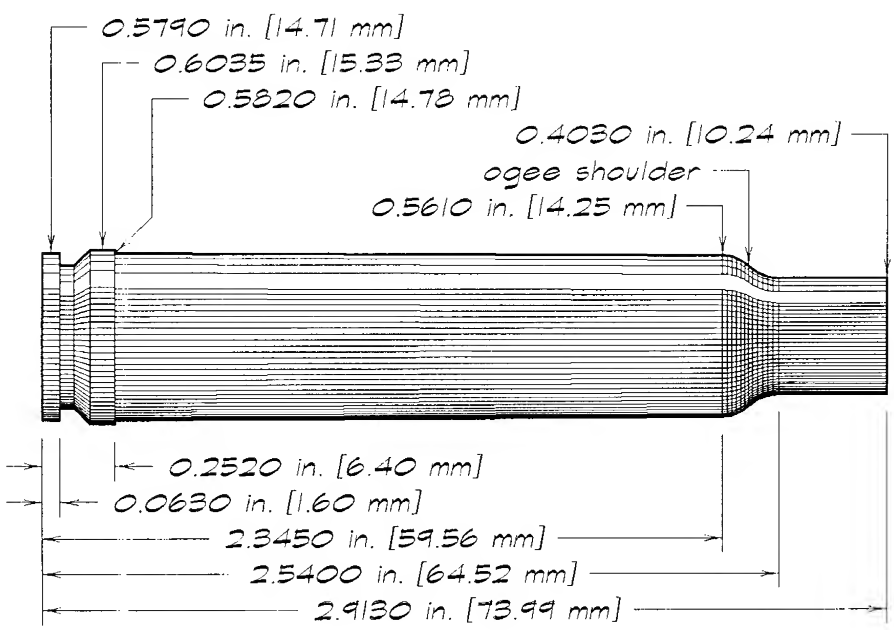


solid:
821 gr brass
96 gr water

.375 bullet displaces 27.93 grains per inch.

Trim .400-.350 NE brass to 2½ inches and resize full-length in .375-06 Rimmed sizer die. Fire-form with inert filler. Trim to 2.5 inches and deburr.

.378 Weatherby Magnum (SAAMI maximums, 1986)



solid:
1,493 gr brass
175 gr water

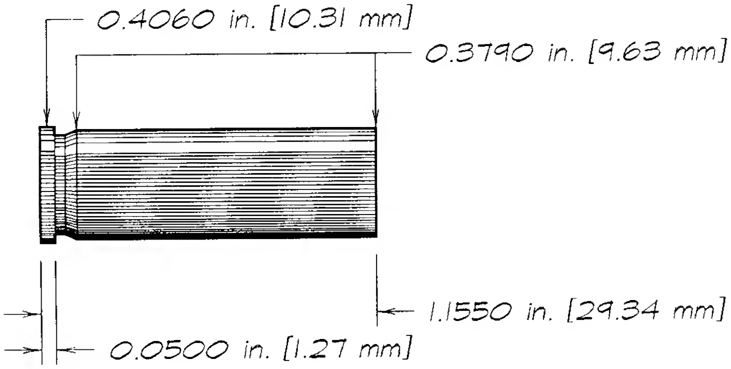
.375 bullet displaces 27.93 grains per inch.

Size .460 Weatherby Magnum case full-length. Fire-form with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.38 AMU (Advanced Marksmanship Unit, U S Army) (SAAMI maximums, 1960)

solid:
293 gr brass
34 gr water

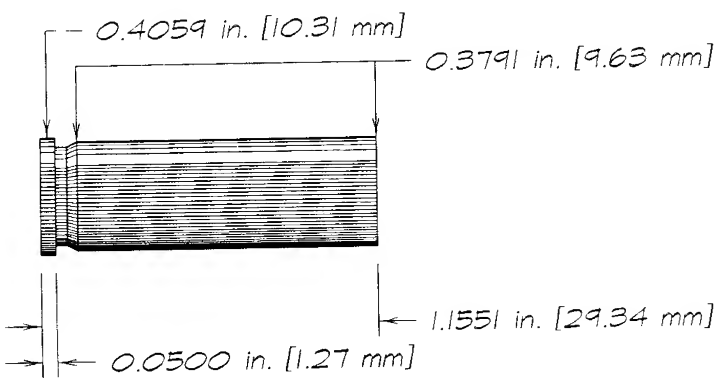


.3587 bullet displaces 25.56 grains per inch.

Use factory .38 AMU brass. Or turn head of .38 Special brass to .38 AMU head dimensions. Or turn head of .357 Magnum brass to .38 AMU head dimensions, trim case length to 1.155 inch, and deburr mouth.

.38 AMU (Triebel maximums)

solid:
293 gr brass
34 gr water



.358 bullet displaces 25.46 grains per inch.

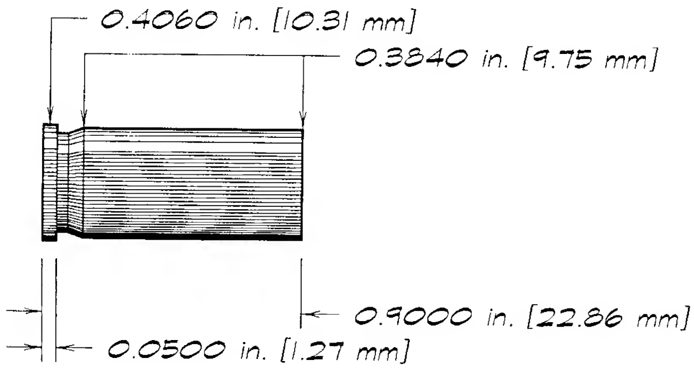
Use the essentially identical .38 Special brass.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.38 Automatic (.38 ACP)
.38 Super Automatic

(SAAMI maximums)

solid:
227 gr brass
27 gr water



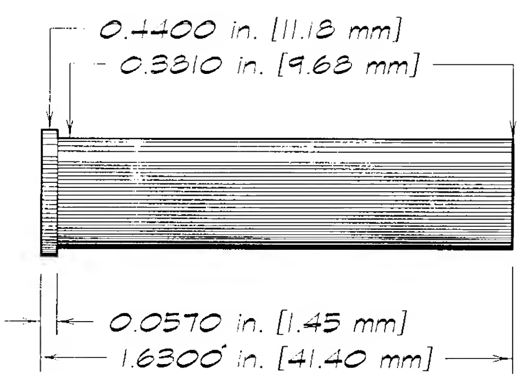
.356 bullet displaces
25.17 grains per inch.

Use factory .38 ACP or .38 Super brass. Or turn heads of .38 Special brass to .38 Super dimensions, shorten to 0.900 inch, and deburr mouths.

.38 Ballara Extra Long

(Winchester drawing, 1912)

solid:
429 gr brass
50 gr water



.358 bullet displaces
25.46 grains per inch.

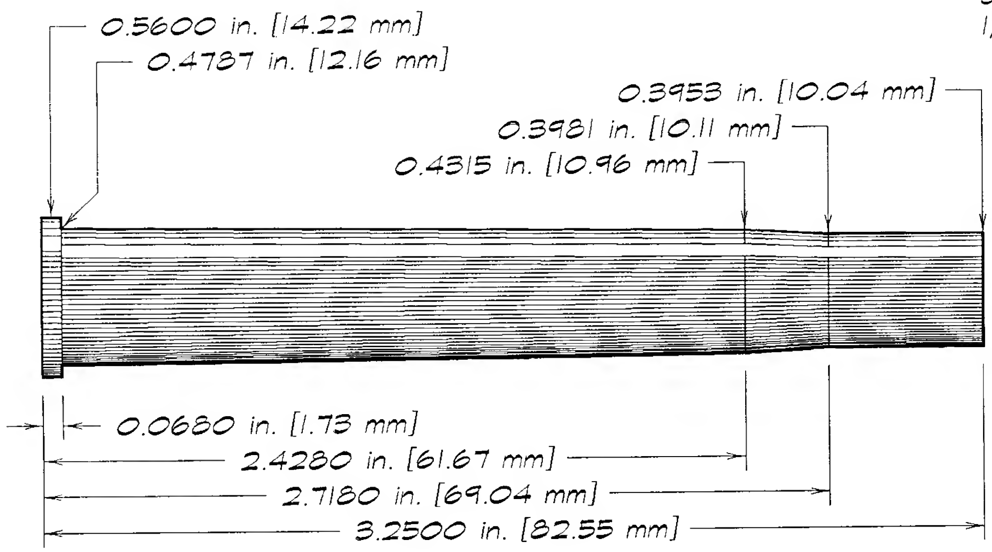
Use .357 Maximum brass (it's 0.04 inch shorter but otherwise almost identical). Or in a pinch, even .357 Magnum brass can have that old gun shooting reduced loads.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.38 Express (.38-90-217)

(Winchester drawing, 1912)

solid:
1,092 gr brass
128 gr water

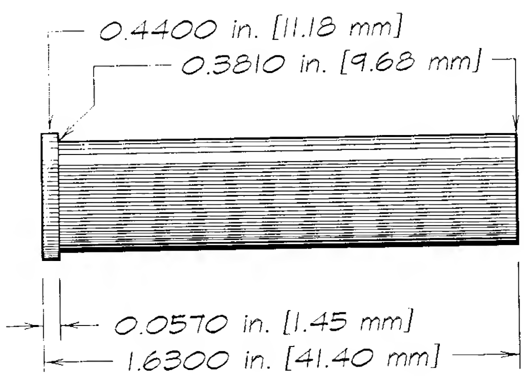


.376 bullet displaces 28.08 grains per inch.

.38 Extra Long Center Fire

(Winchester drawing, 1912)

solid:
429 gr brass
50 gr water



.358 bullet displaces 25.46 grains per inch.

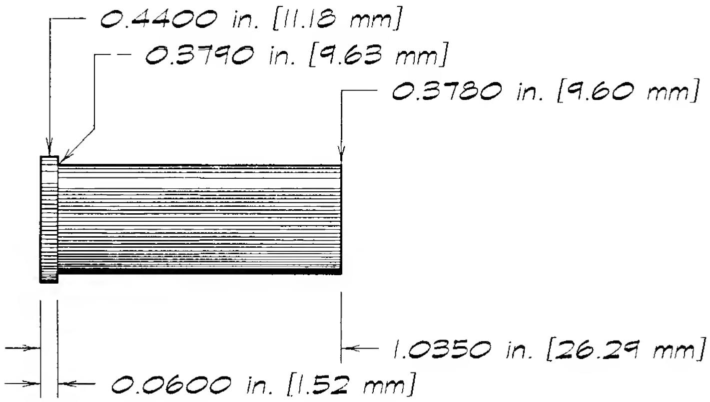
Use .357 Remington Maximum brass.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.38 Long Colt

(SAAMI maximums)

solid:
254 gr brass
30 gr water



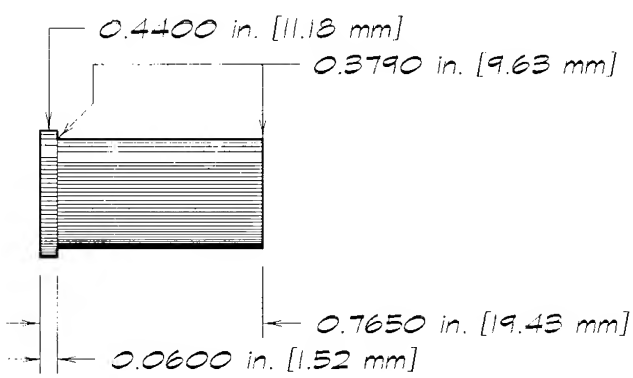
.358 bullet displaces
25.46 grains per inch.

Use factory .38 Long Colt brass. Or trim .38 Special brass to 1.035 inch long and deburr mouths.

.38 Short Colt

(SAAMI maximums)

solid:
189 gr brass
22 gr water



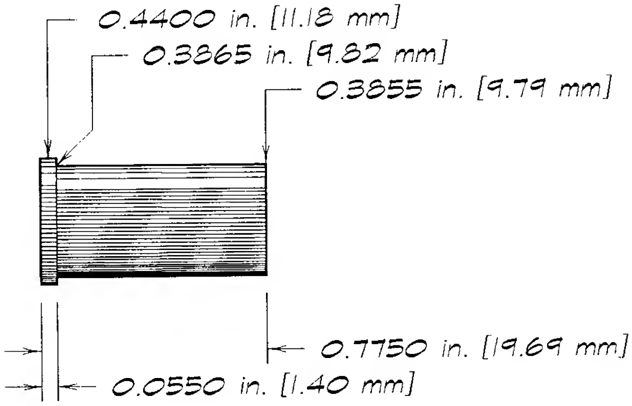
.358 bullet displaces
25.46 grains per inch.

Use factory .38 Short Colt brass. Or trim .38 Special brass to 0.765 inch long and deburr mouths.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.38 Smith & Wesson (.38 S&W, .38 Colt New Police) (SAAMI maximums)

solid:
209 gr brass
24 gr water

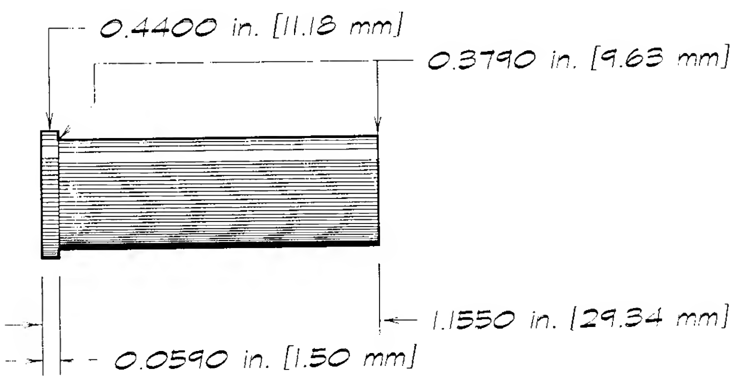


.361 bullet displaces
25.88 grains per inch.

Use factory .38 S&W or .38 Colt NP brass. Or shorten .38 Special brass to 0.775 inch and fire-form with moderate load.

.38 Special (SAAMI maximums)

solid:
283 gr brass
33 gr water

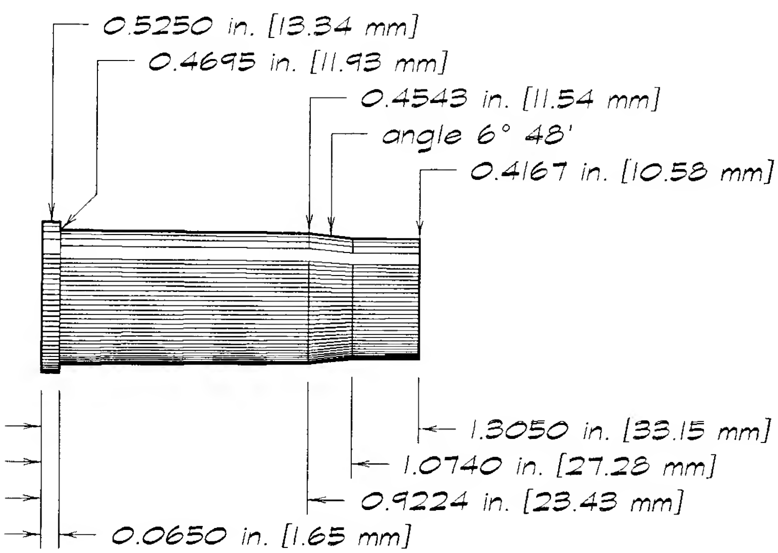


.358 bullet displaces
25.46 grains per inch.

Use factory .38 Special brass. Or shorten .357 Magnum or .357 Maximum brass to 1.155 inch long and deburr mouths.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.38-40 Winchester (.38 WCF) (SAAMI maximums)

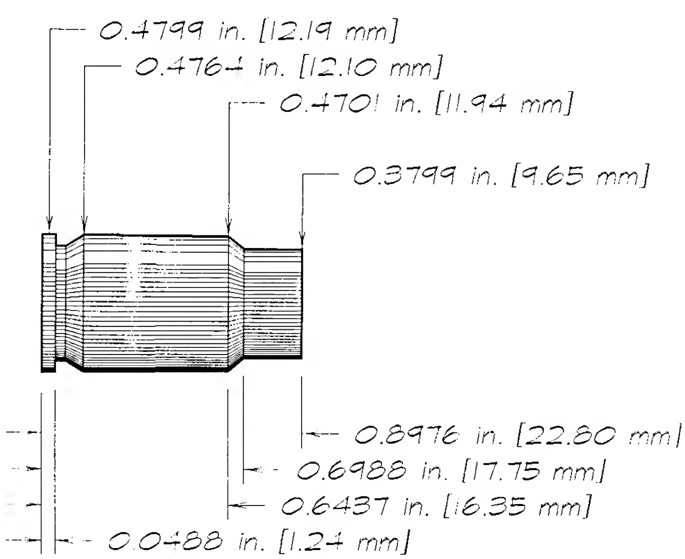


solid:
478 gr brass
56 gr water

.400 bullet displaces
31.78 grains per inch.

Use recently factory-made .38-40 Winchester brass. Or resize .44-40 Winchester brass full-length in .38-40 sizer die.

.38-.45 ACP (CIP maximums)



solid:
306 gr brass
36 gr water

.359 bullet displaces
25.60 grains per inch.

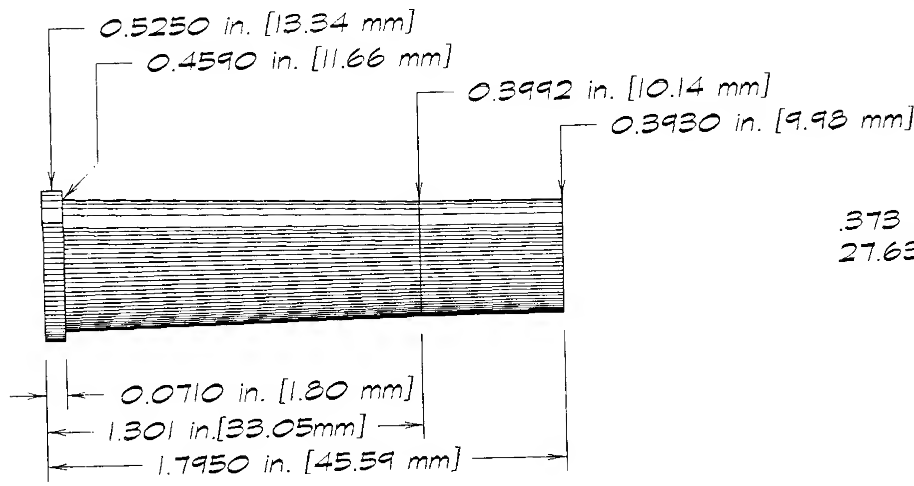
Use factory .38-.45 ACP brass (if CIP status means factory brass is available). Or form from .45 ACP brass (using only new, unfired brass), in RCBS form dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.38-45 Bullard

(Winchester drawing 1912)

solid:
557 gr brass
65 gr water



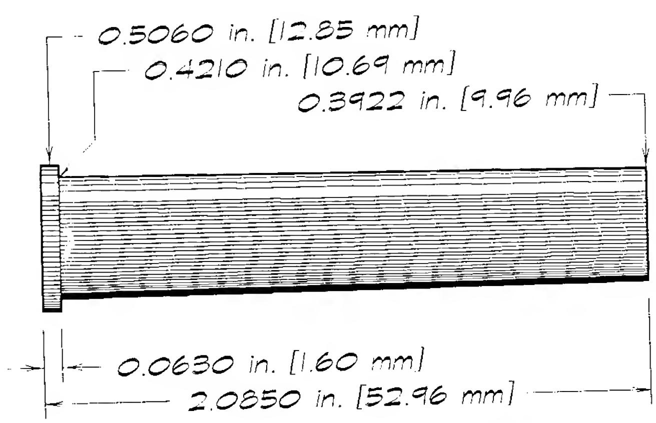
.373 bullet displaces
27.63 grains per inch.

Anneal neck and shoulder of .303 British case. Fire-form with inert filler. Trim to length and chamfer mouth.

.38-55 Winchester

(SAAMI maximums)

solid:
601 gr brass
70 gr water

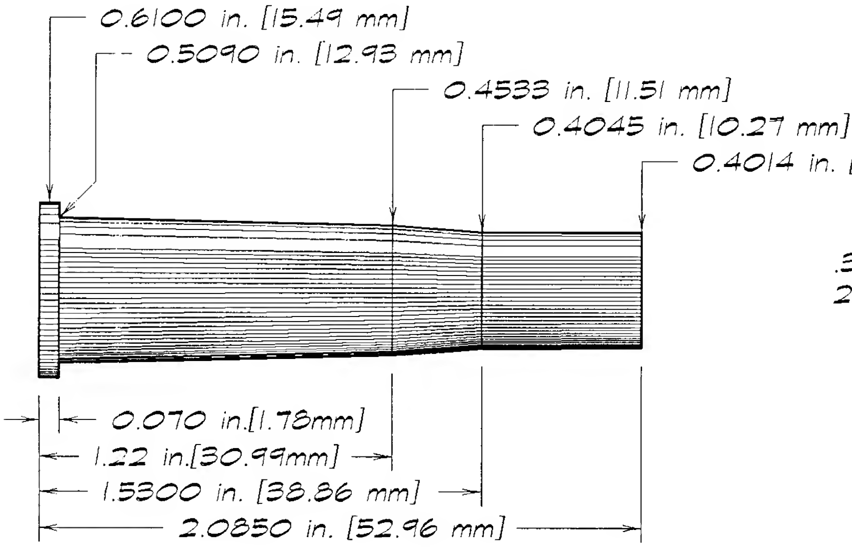


.377 bullet displaces
28.23 grains per inch.

Use recently factory-made .38-55 Winchester brass. Or if a shorter case is all right, use .375 Winchester brass. Or anneal .30-30 Winchester brass half-way down the body and fire-form with inert filler, for another shorter version.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.38-56 Winchester (Winchester drawing, 1912)

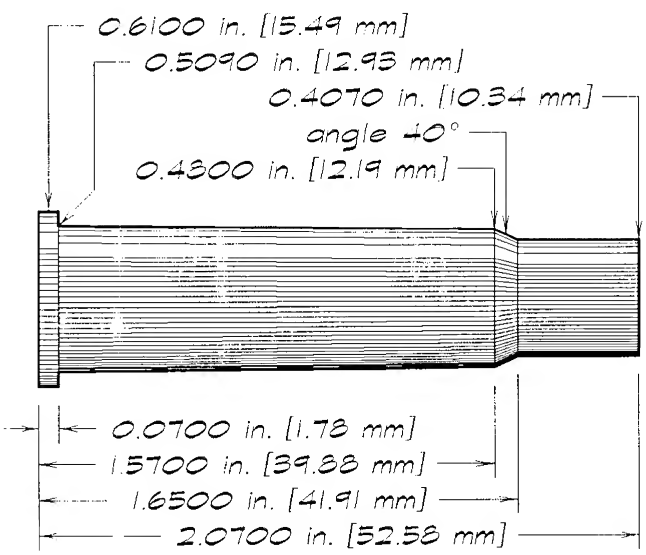


solid:
728 gr brass
85 gr water

.375 bullet displaces
27.93 grains per inch.

Use recently manufactured .38-56 Winchester brass. Or form from .45-70 Springfield or Huntington .45 Basic brass, in RCBS form and trim dies.

.38-56 Winchester Improved (David J LeGate)



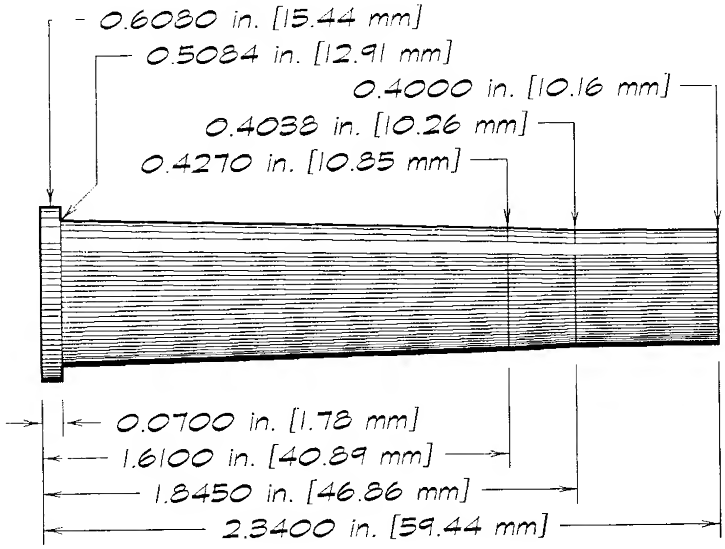
solid:
736 gr brass
86 gr water

.375 bullet displaces
27.93 grains per inch.

Use recently manufactured .38-56 Winchester brass, or form from .45-70 Springfield or Huntington .45 Basic brass, in RCBS form and trim dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.38-70 Winchester (Winchester drawing, 1912)

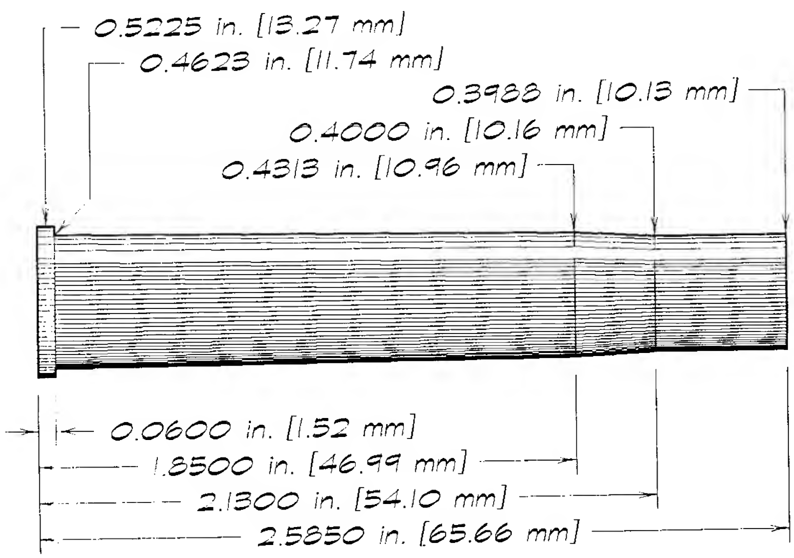


.376 bullet displaces
28.08 grains per inch.

Form from Huntington .45 Basic brass, in RCBS form die. Trim to length and chamfer mouth.

.38-72 Winchester (Winchester drawing, 1912)

solid:
845 gr brass
99 gr water



.378 bullet displaces
28.38 grains per inch.

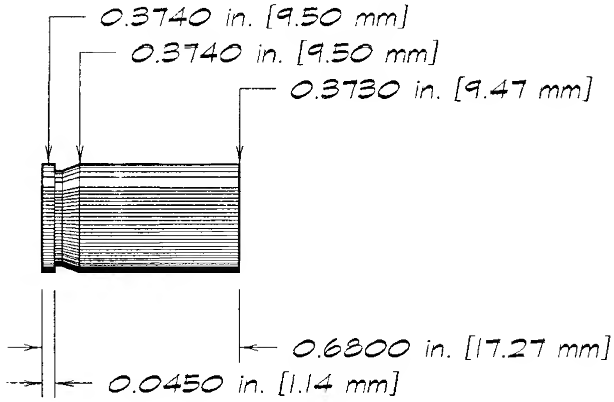
Form from recently manufactured .38-72 Basic or .405 Basic brass, in respective RCBS form die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.380 Automatic (.380 ACP, 9mm Kurz
9mm Corto, 9mm Short)

(SAAMI maximums)

solid:
155 gr brass
18 gr water



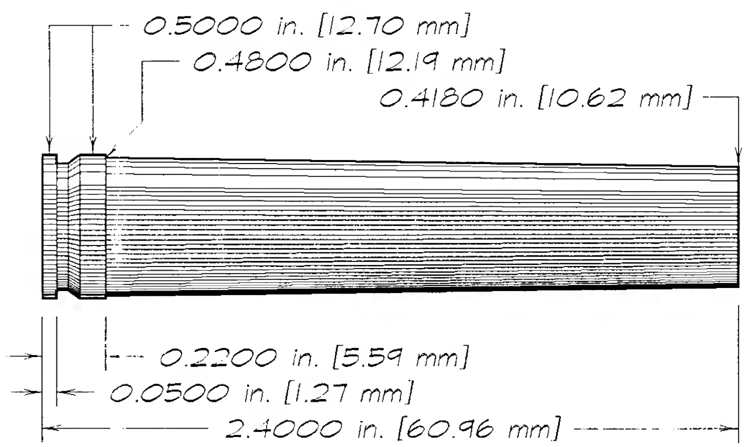
.356 bullet displaces
25.17 grains per inch.

Use Boxer-primed .380 Auto factory brass. Or anneal upper body of .222 or .223 Remington brass, trim to 0.680 inch long, ream inside mouth with 0.355-inch reamer, and deburr.

.380 Cogswell & Harrison

(Kynoch drawing, 1920)

solid:
863 gr brass
101 gr water

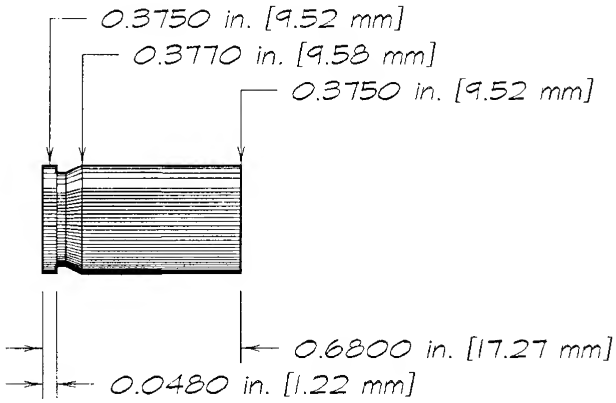


.388 bullet displaces
29.90 grains per inch.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.380 Hammerless (Webley 9mm Short) (ICI Metals Ltd dwg)

solid:
157 gr brass
18 gr water

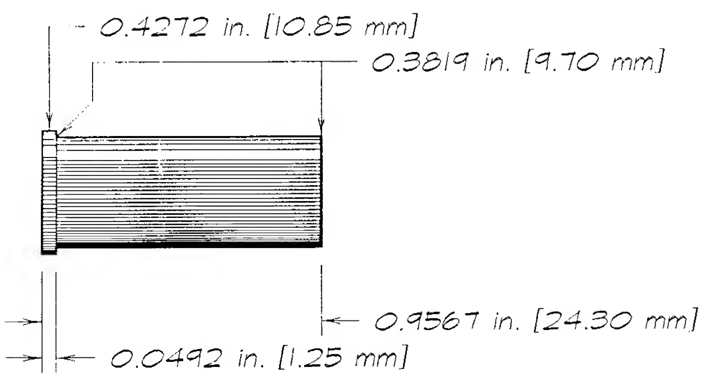


.356 bullet displaces
25.17 grains per inch.

Use factory brass (.380 Auto, .380 ACP, 9mm Corto, 9mm Kurz, 9mm Short). Or anneal upper body of .222 or .223 Remington, trim to 0.68 inch, ream inside neck in RCBS ream die, and deburr.

.380 Long (CIP maximums)

solid:
260 gr brass
31 gr water



.360 bullet displaces
25.74 grains per inch.

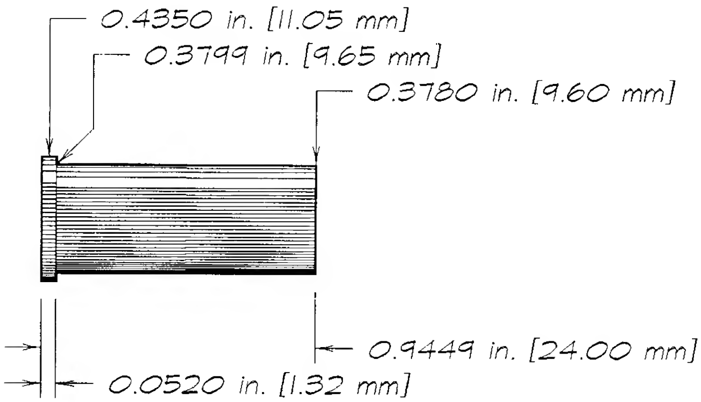
Use factory .380 Long brass. Or trim .38 Special or .357 Magnum brass to 0.956 inch long (and turn rim to .380 Long dimensions, if necessary).

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.380 Long Rifle

(CIP maximums)

solid:
244 gr brass
29 gr water



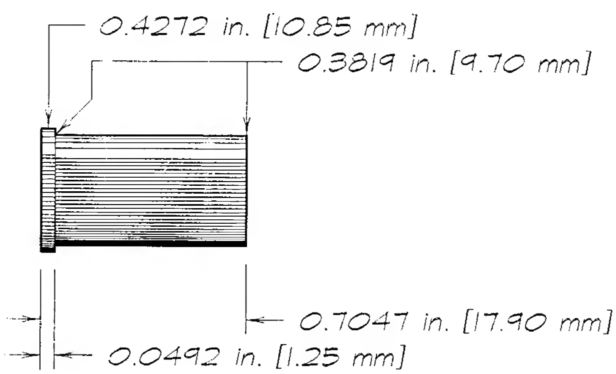
.373 bullet displaces
27.63 grains per inch.

Use factory .380 Long Rifle brass. Or trim .38 Special or .357 Magnum brass to 0.944 inch long and deburr.

.380 Short

(CIP maximums)

solid:
192 gr brass
23 gr water



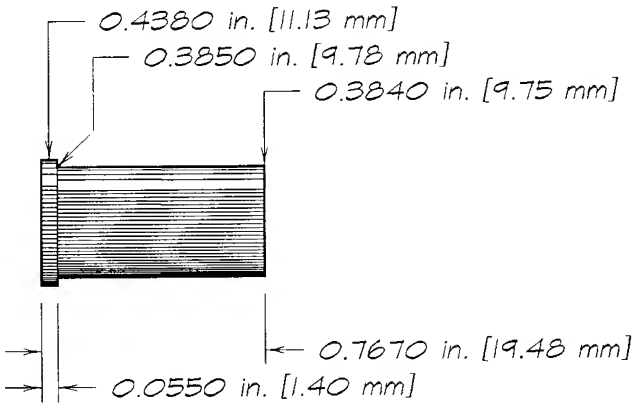
.360 bullet displaces
25.74 grains per inch.

Use factory .380 Short brass. Or trim .38 Short Colt brass to 0.704 inch and deburr. Turn rim to .380 Short dimensions, if necessary.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.380-.200 Webley Mk IV Revolver (ICI Metals Ltd dwg)

solid:
207 gr brass
24 gr water

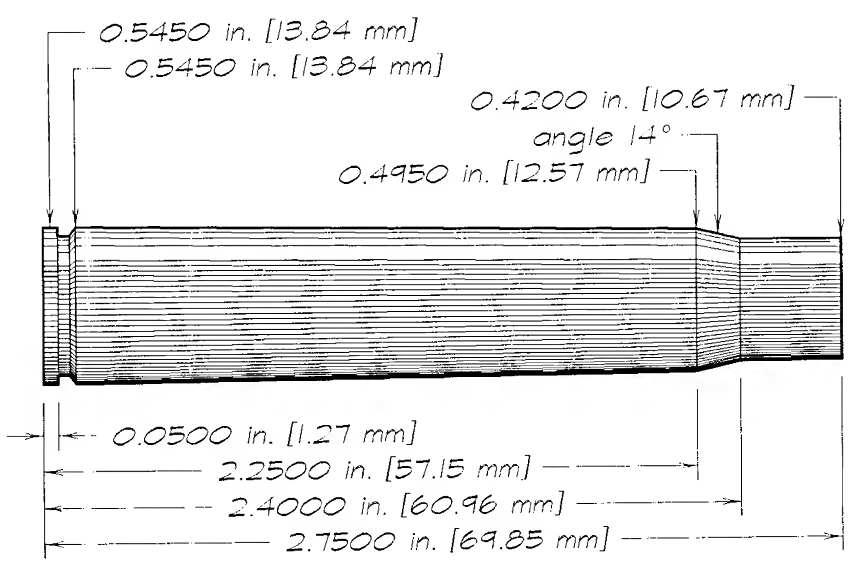


.361 bullet displaces 25.88 grains per inch.

Trim the slightly longer .38 S&W (.38 Colt NP) to 0.767 inch and deburr.

.383 Vickers (Manton) (Kynoch drawing, 1922)

solid:
1,220 gr brass
143 gr water



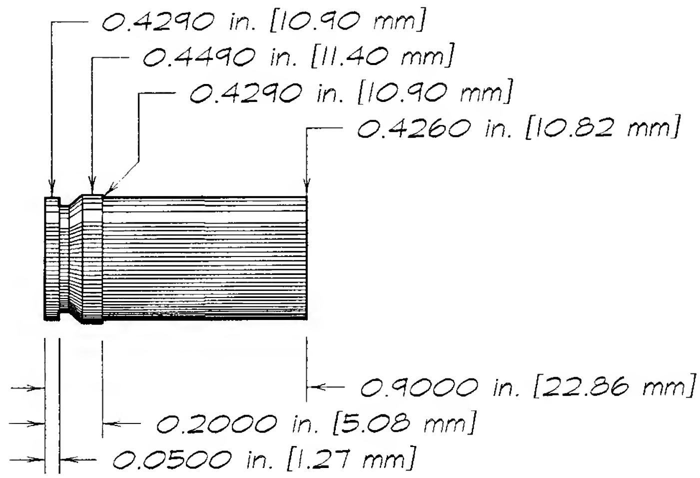
.390 bullet displaces 30.21 grains per inch.

Resize .404 Jeffery brass full-length in .383 Vickers sizer die. Fire-form with inert filler, trim to 2.75 inches, and deburr.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

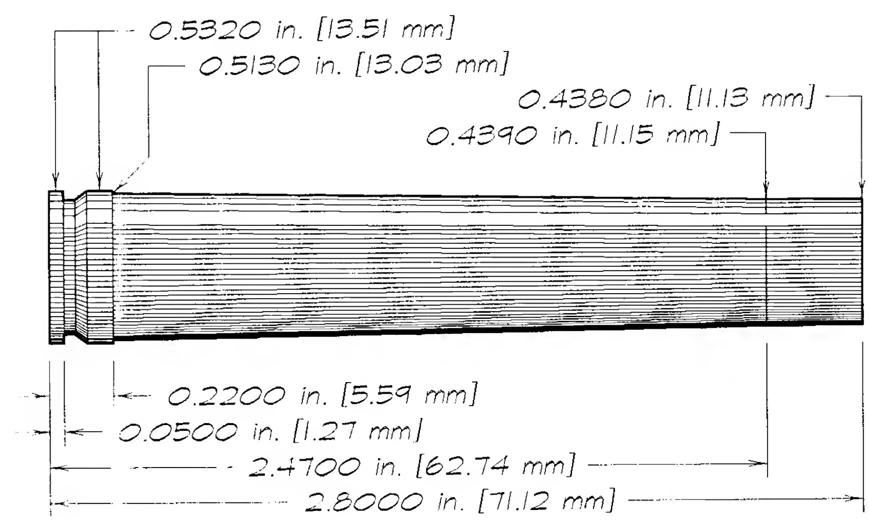
.39 BSA Auto Pistol Cartridge (Kynoch drawing, 1921)

solid:
284 gr brass
33 gr water



.40 BSA (Kynoch drawing, 1921)

solid:
1,101 gr brass
129 gr water



.408 bullet displaces 33.06 grains per inch.

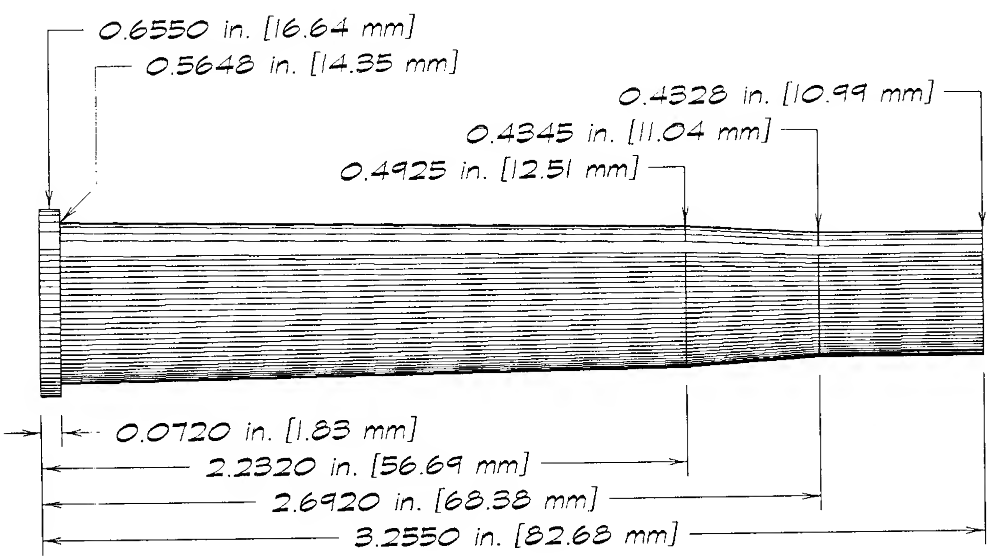
Anneal neck, shoulder, and upper body of .375 H&H Magnum brass and fire-form with inert filler. Trim and deburr.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.40 Express (.40-110)

(Winchester drawing, 1912)

solid:
1,396 gr brass
164 gr water



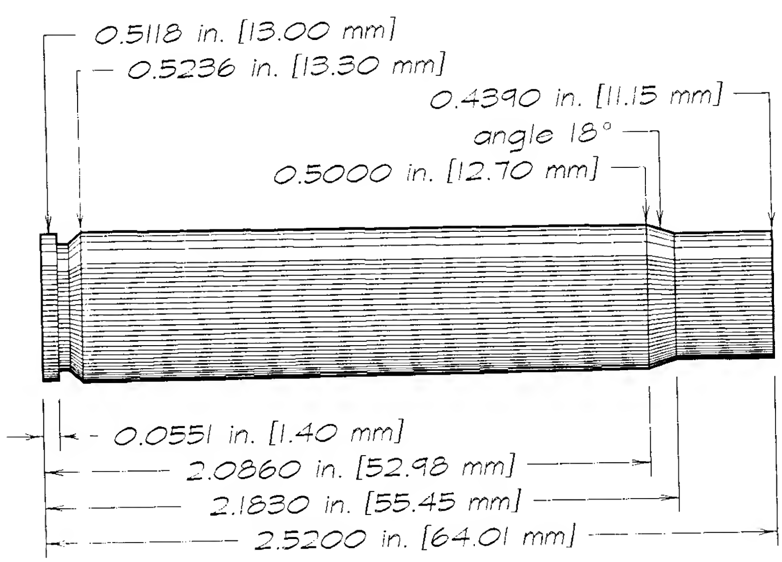
.403 bullet displaces 32.26 grains per inch.

Form from .450 Nitro Express Basic case, in RCBS form die.

.40 Newton

(Newton drawing*)

solid:
1,062 gr brass
125 gr water



.408 bullet displaces 33.06 grains per inch.

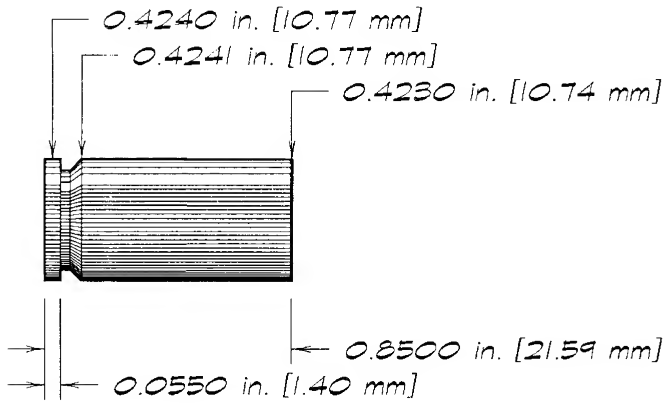
Form from 8x68mm S brass, in RCBS form and trim dies.

*derived from Newton factory dimensions for .40 Newton chamber

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.40 Smith & Wesson (SAAMI maximums)

solid:
248 gr brass
29 gr water

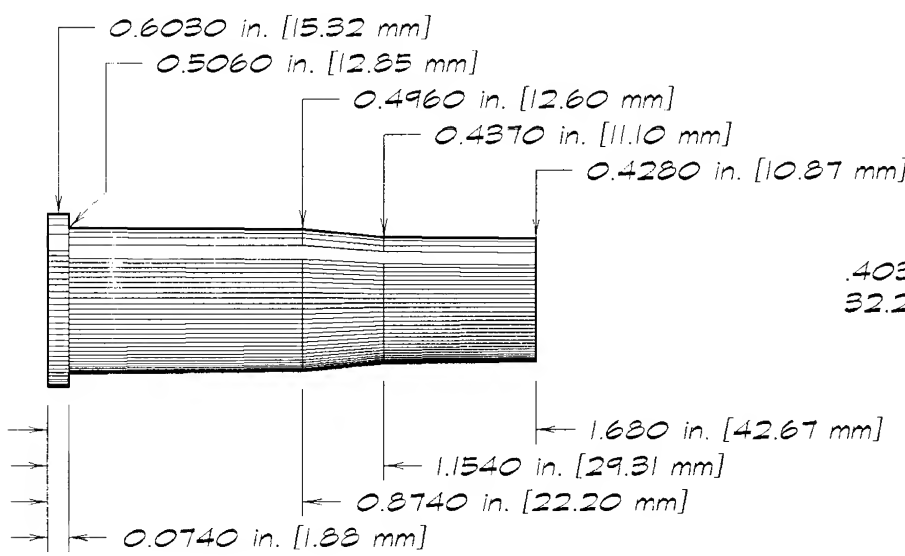


.400 bullet displaces
31.78 grains per inch.

Use factory .40 S&W brass. Or anneal upper body of .30 or .32 Remington brass, shorten to 0.850 inch long, ream inside mouth, and deburr.

.40-50 Sharps Bottleneck (Winchester drawing, 1912)

solid:
655 gr brass
77 gr water



.403 bullet displaces
32.26 grains per inch.

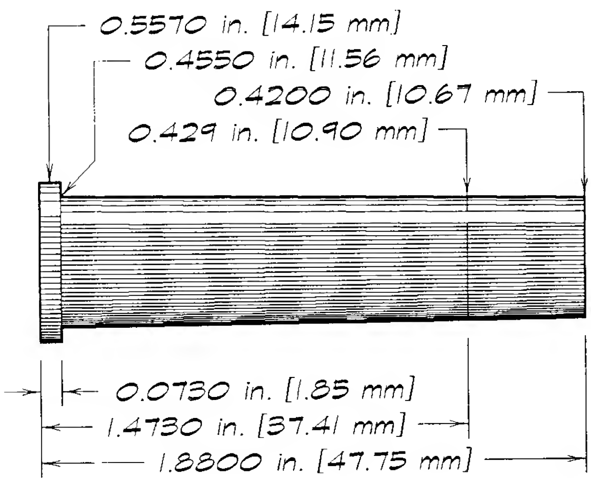
Form from .45-70 Springfield or Huntington .45 Basic brass, in respective RCBS form and trim dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.40-50 Sharps Straight

(Winchester drawing, 1912)

solid:
639 gr brass
75 gr water



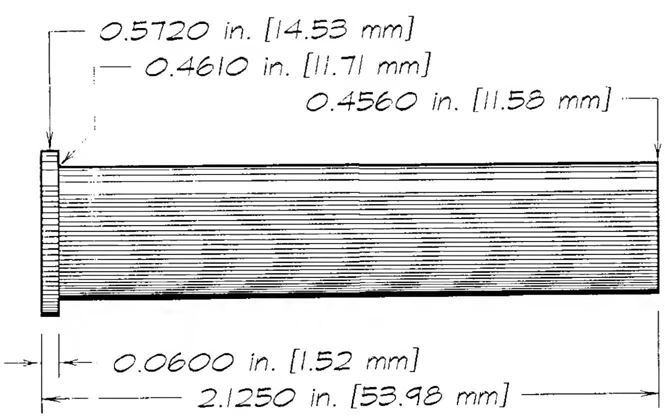
.403 bullet displaces
32.26 grains per inch.

Form from .30-40 Krag or .405 Basic brass, in RCBS form and trim dies.

.40-60 Ballard "Everlasting"

(specimen cases)

solid:
783 gr brass
92 gr water



.403 bullet displaces
32.26 grains per inch.

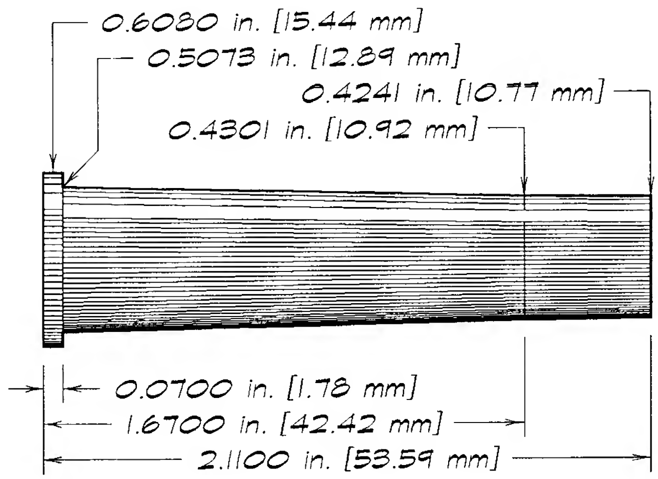
Fire-form .30-40 Krag brass with inert filler. Trim to 2.125 inches. Deburr.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.40-60 Marlin

(Winchester drawing, 1912)

solid:
783 gr brass
92 gr water



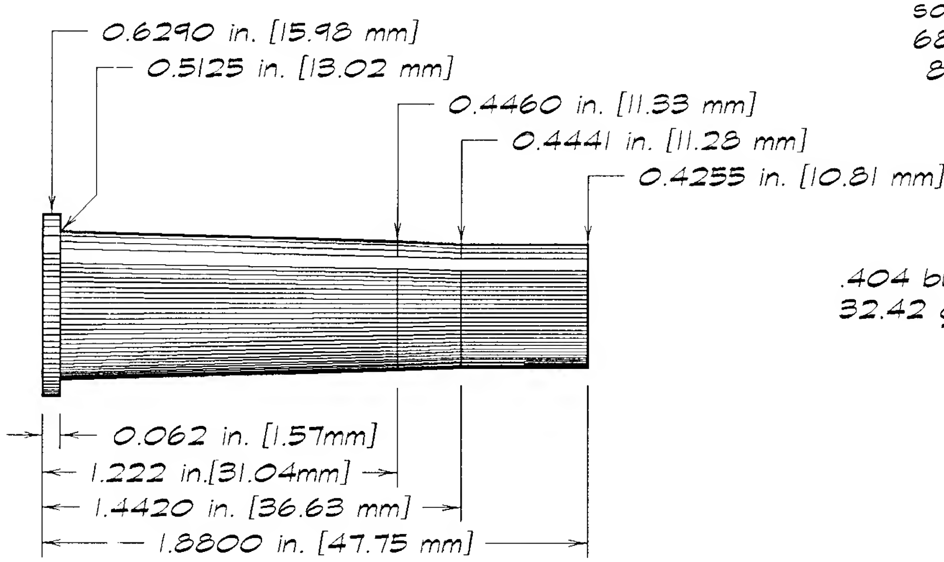
.403 bullet displaces
32.26 grains per inch.

Form from .45-70 Springfield or Huntington .45 Basic brass, in respective RCBS form and trim dies.

40-60 Winchester

(Winchester drawing, 1912)

solid:
680 gr brass
80 gr water



.404 bullet displaces
32.42 grains per inch.

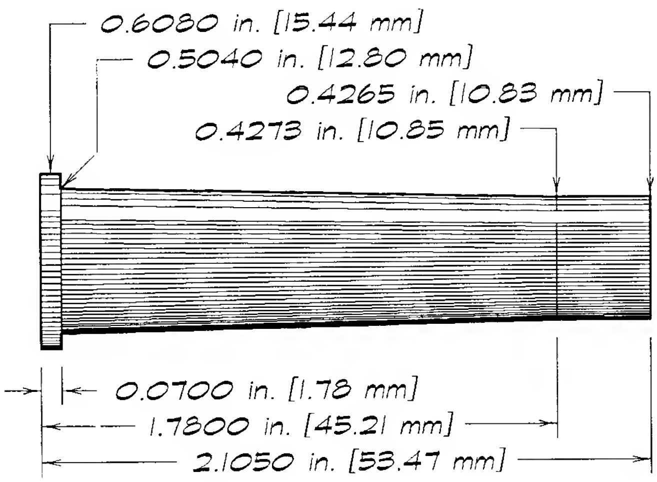
Form from Huntington .45 Basic brass or .45-70 Springfield, in respective RCBS form and trim dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.40-65 Winchester

(Winchester drawing, 1912)

solid:
785 gr brass
92 gr water



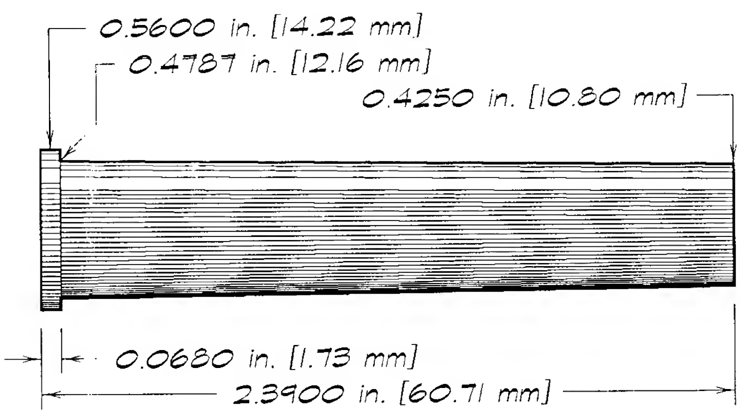
.406 bullet displaces
32.74 grains per inch.

Use recently manufactured .40-65 brass. Or form from Huntington .45 Basic or .45-70 Springfield brass, in RCBS form and trim dies.

.40-70 (& .40-63) Ballard

(Winchester drawing, 1912)

solid:
842 gr brass
99 gr water



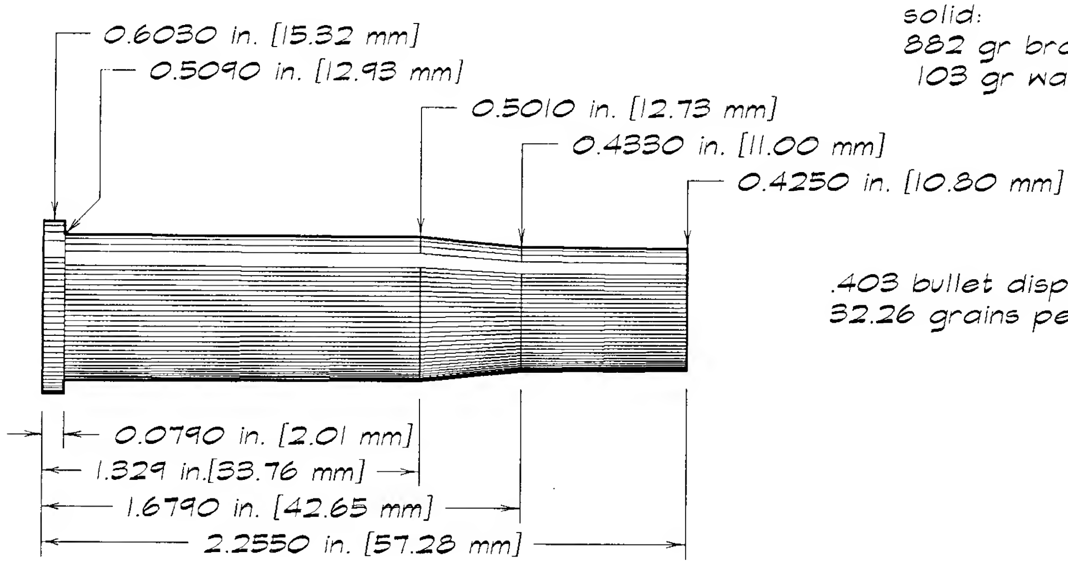
.403 bullet displaces
32.26 grains per inch.

Form from 9.3x74mm Rimmed case, in RCBS form and trim dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.40-70 Sharps Bottle Neck (Winchester drawing, 1912)

solid:
882 gr brass
103 gr water

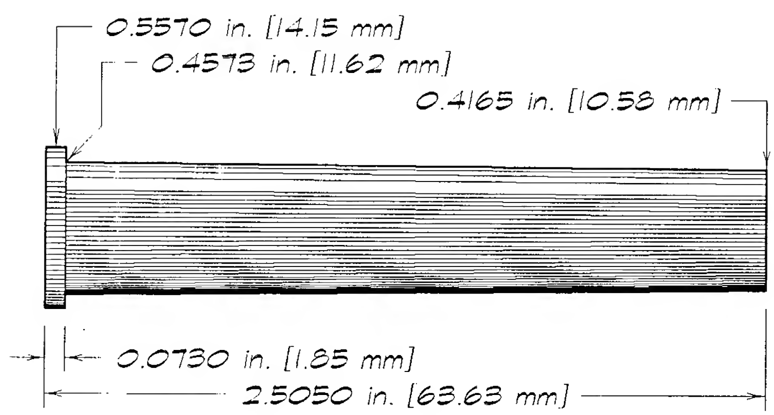


.403 bullet displaces
32.26 grains per inch.

Form from Huntington .45 Basic brass, in RCBS form die. Or, if a short neck is all right, form from .45-70 Springfield brass, in RCBS form and trim dies.

.40-70 Sharps Straight (Winchester drawing, 1912)

solid:
778 gr brass
91 gr water



.403 bullet displaces
32.26 grains per inch.

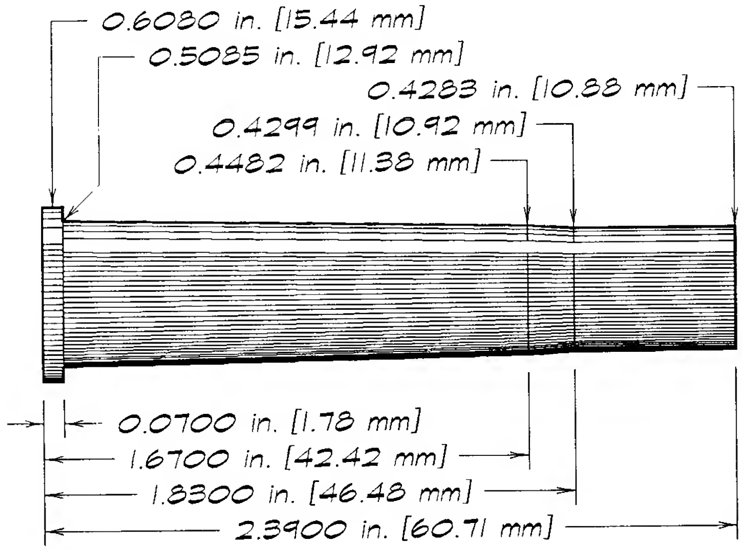
Use recently manufactured .40-70 Sharps Straight brass. Or form from .405 Basic or 9.3x74mm Rimmed brass, in respective RCBS form and trim dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

40-70 Winchester

(Winchester drawing, 1912)

solid:
905 gr brass
106 gr water



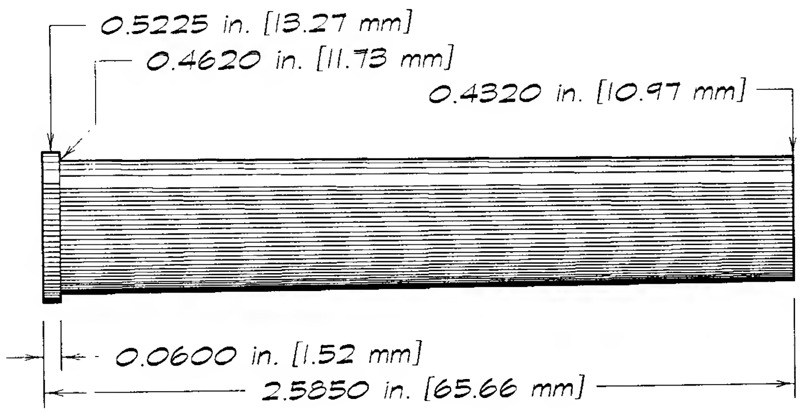
.405 bullet displaces
32.58 grains per inch.

Form from Huntington .45 Basic brass, in RCBS form and trim dies.

.40-72 Winchester

(Winchester drawing, 1912)

solid:
887 gr brass
104 gr water

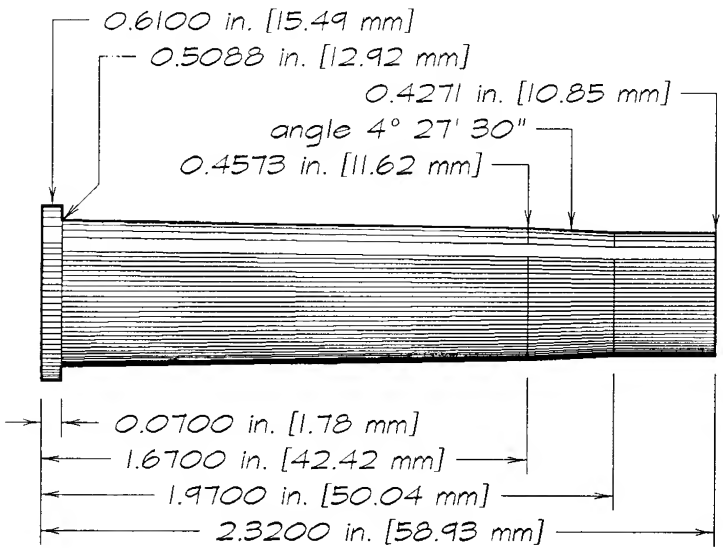


.406 bullet displaces
32.74 grains per inch.

Use recently manufactured .40-72 brass. Or form from .405 Basic or 9.3x74mm Rimmed brass, in respective RCBS form and trim dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.40-82 Winchester (SAAMI maximums, 1938)

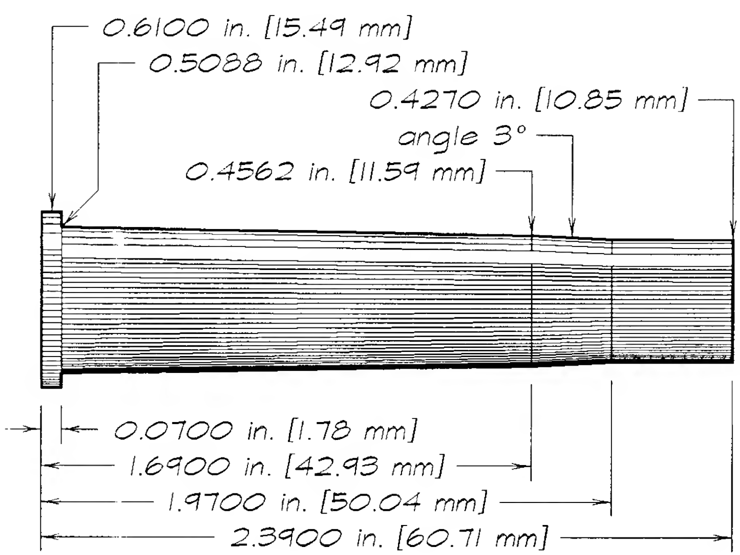


solid:
890 gr brass
104 gr water

.408 bullet displaces
33.06 grains per inch.

Use recently manufactured .40-82 brass. Or form from .45-70 Government or HDS .45 Basic brass, in RCBS form and trim dies.

.40-82 Winchester (Winchester drawing, 1912)



solid:
910 gr brass
107 gr water

.408 bullet displaces
33.06 grains per inch.

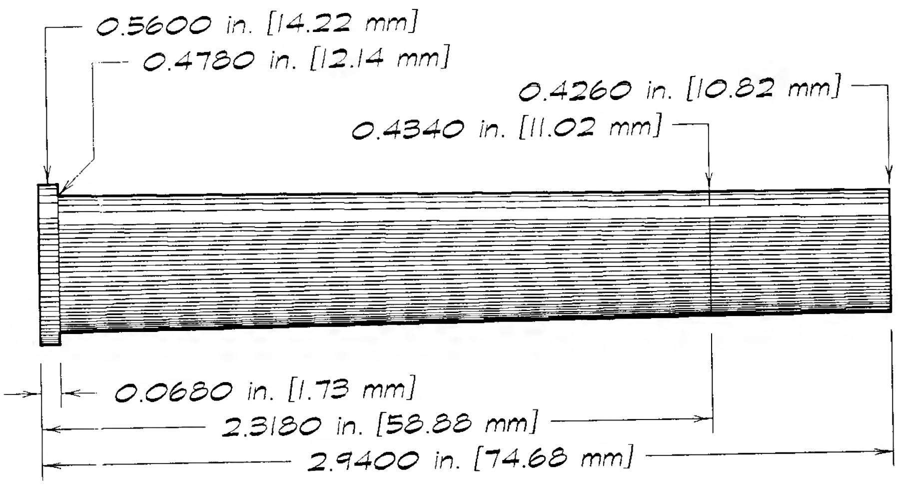
Use recently manufactured .40-82 brass. Or form from .45-70 Government or HDS .45 Basic brass, in respective RCBS form and trim dies.

Anneal only by method shown in text.   Text explains use of "solid" and displacement figures.

.40-85 Ballard

(Winchester drawing, 1912)

solid:
1,027 gr brass
121 gr water



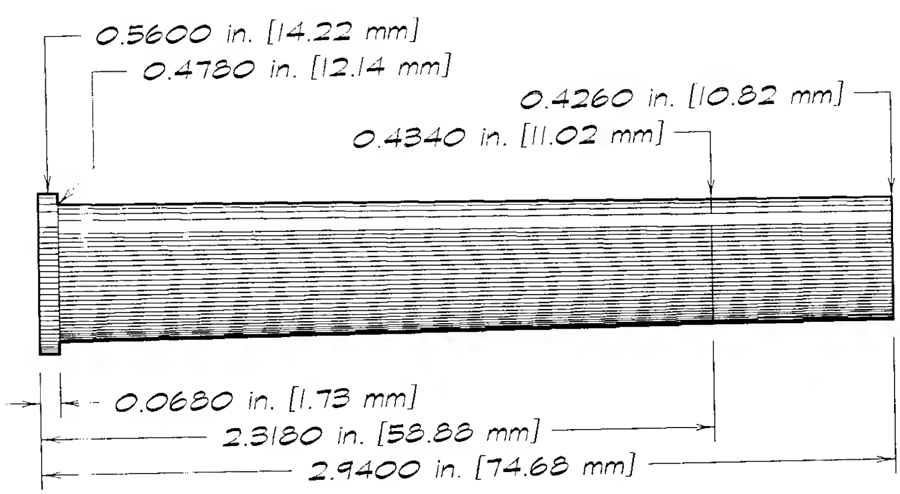
.403 bullet displaces 32.26 grains per inch.

Form from .375 Flanged Magnum case, in RCBS form dies.

.40-90 Ballard

(Winchester drawing, 1912)

solid:
1,027 gr brass
121 gr water

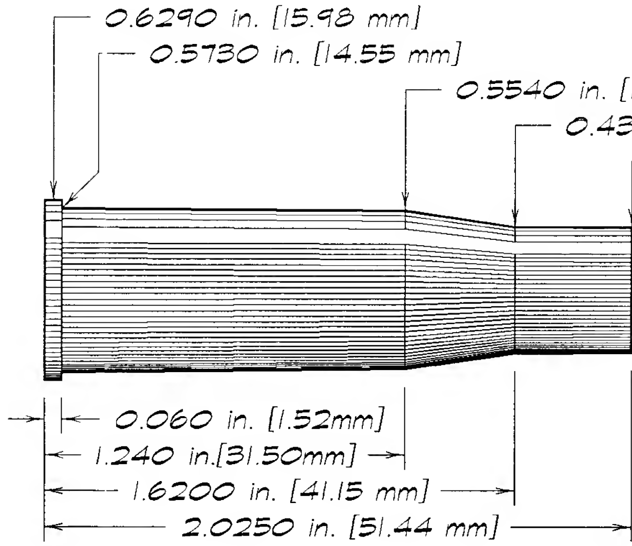


.403 bullet displaces 32.26 gr/in.

Form from Huntington .45 Basic brass, in RCBS form dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.40-90 Bullard (Winchester drawing, 1912)

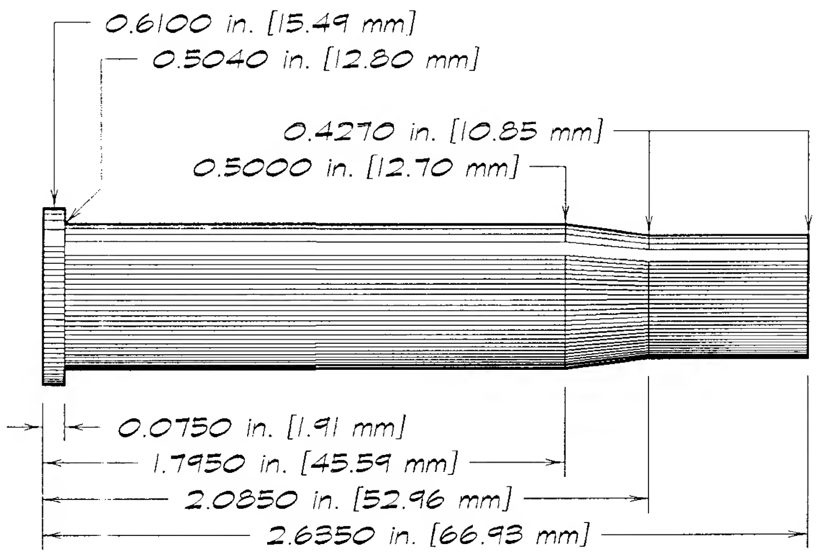


solid:
1,007 gr brass
118 gr water

.413 bullet displaces 33.88 grains per inch.

Form .50 Sharps Basic brass in RCBS form dies. Turn rim to 0.62-0.63 inch diameter if necessary. Trim to 2.0 inches. Deburr.

.40-90 Sharps Bottle Neck (Winchester drawing, 1912)



solid:
1,046 gr brass
123 gr water

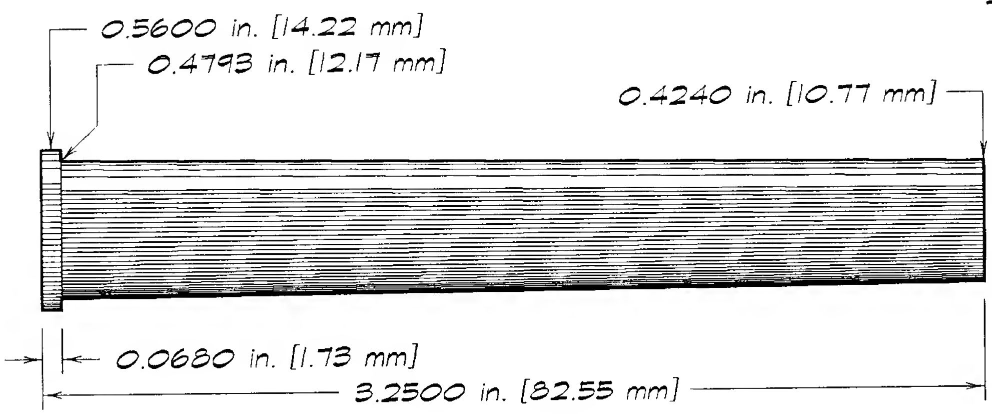
.403 bullet displaces 32.26 gr/in.

Form from Huntington .45 Basic brass, in RCBS form dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.40-90 Sharps Straight (Winchester drawing, 1912)

solid:
1,140 gr brass
134 gr water

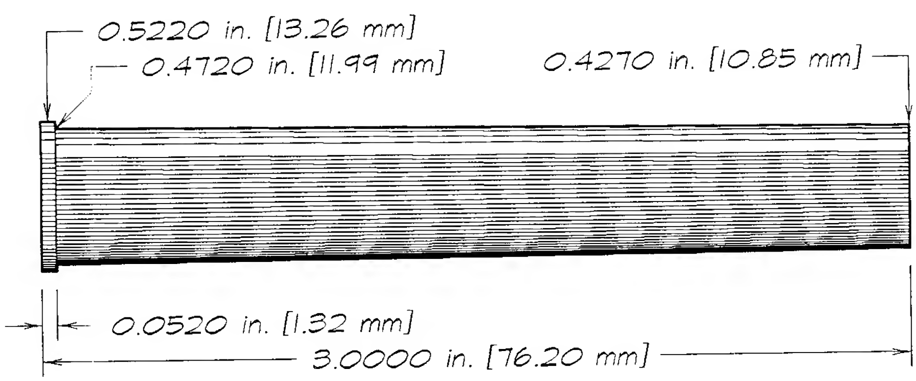


.403 bullet displaces 32.26 gr/in.

Use recently manufactured .40-90 Sharps Straight brass. Or form from Huntington .45 Basic brass, in RCBS form die.

.400 Nitro for Black Powder Express 3-Inch (Purdey) (Birmingham Proof House)

solid:
1,056 gr brass
124 gr water

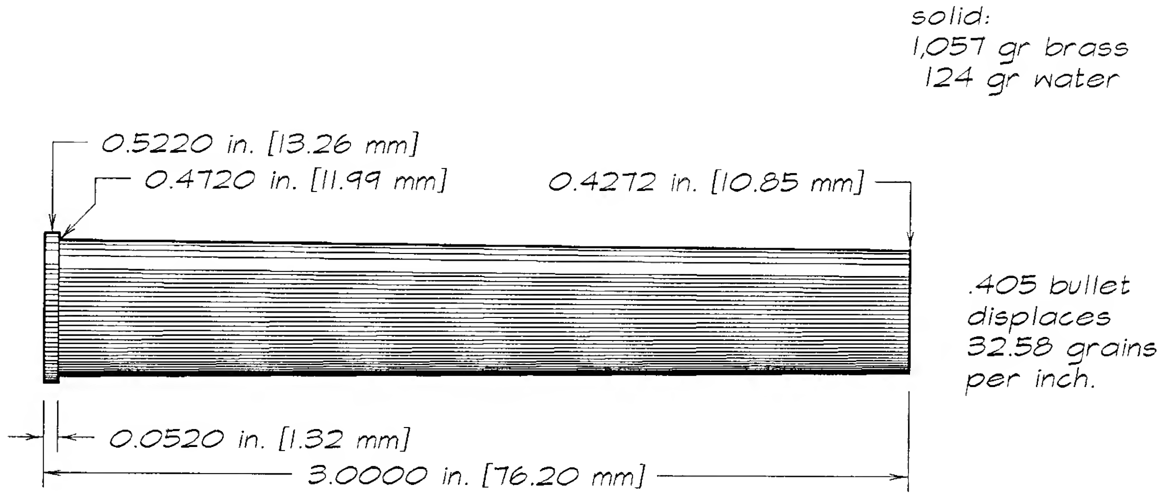


.405 bullet displaces 32.58 grains per inch.

Use factory .400 NEBP 3-Inch brass. Or fire-form 9.3x74mm Rimmed brass for slightly shorter case. Ream neck, in RCBS neck-ream die.

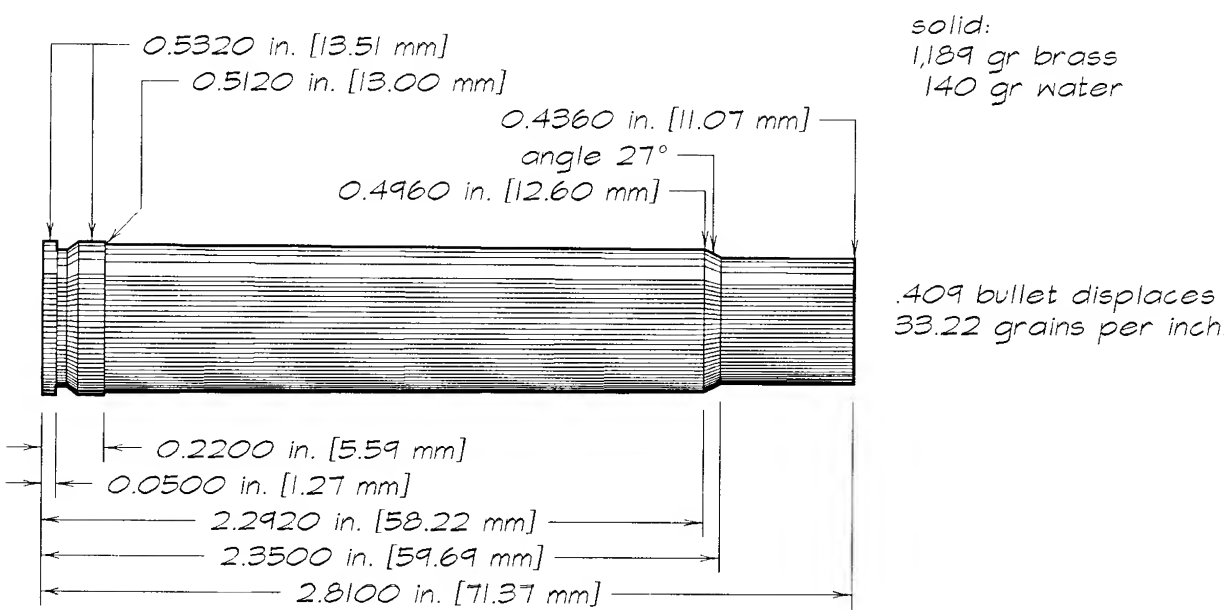
Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.400 Nitro Express Black Powder 3-Inch Purdey (CIP maximums)



Use factory .400 NEBP 3-Inch brass. Or fire-form 9.3x74mm Rimmed brass for slightly shorter case. Ream neck, in RCBS neck-ream die.

.400 Pondoro (A-Square maximums)



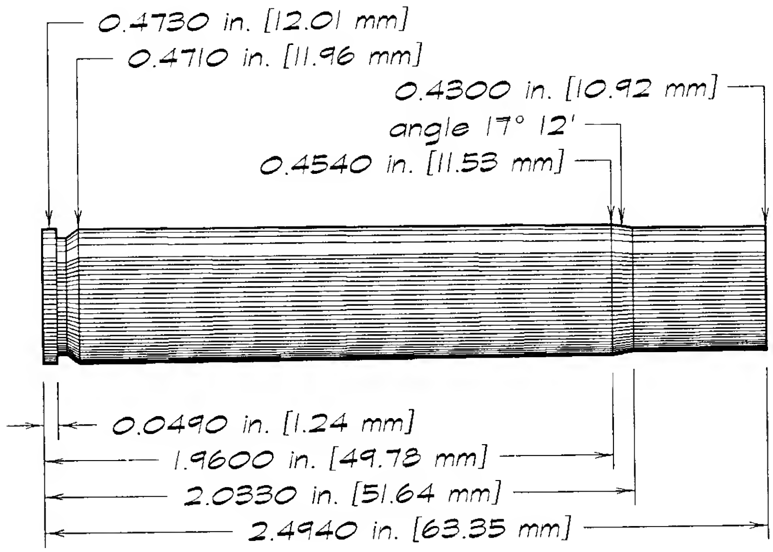
Use A-Square or A-Cube factory brass. Or resize .375 H&H Magnum brass full-length in .400 Pondoro sizer die, then fire-form with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.400 Whelen

(Keith Francis drawing)

solid:
889 gr brass
104 gr water



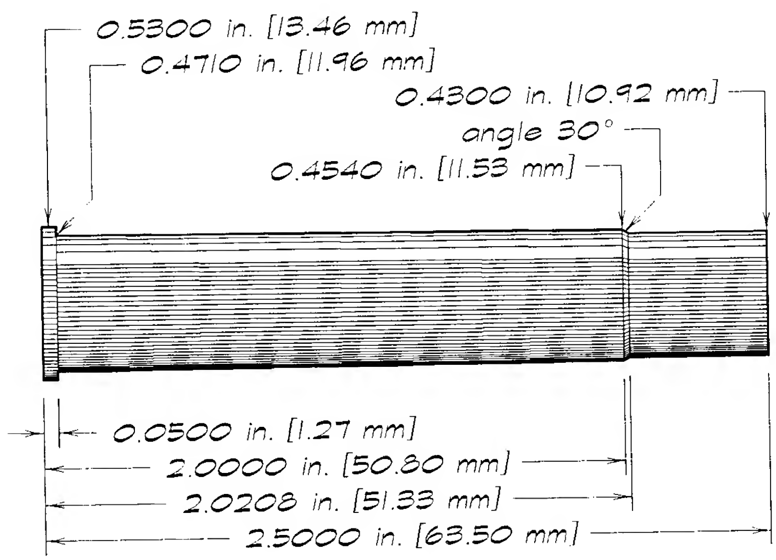
.411 bullet displaces 33.55 grains per inch.

Anneal neck, shoulder, and upper body of .35 Whelen brass. Expand with tapered expander or succession of intermediate expanders. Fire-form with inert filler.

.400 Whelen Rimmed

(designer's specs)

solid:
819 gr brass
96 gr water



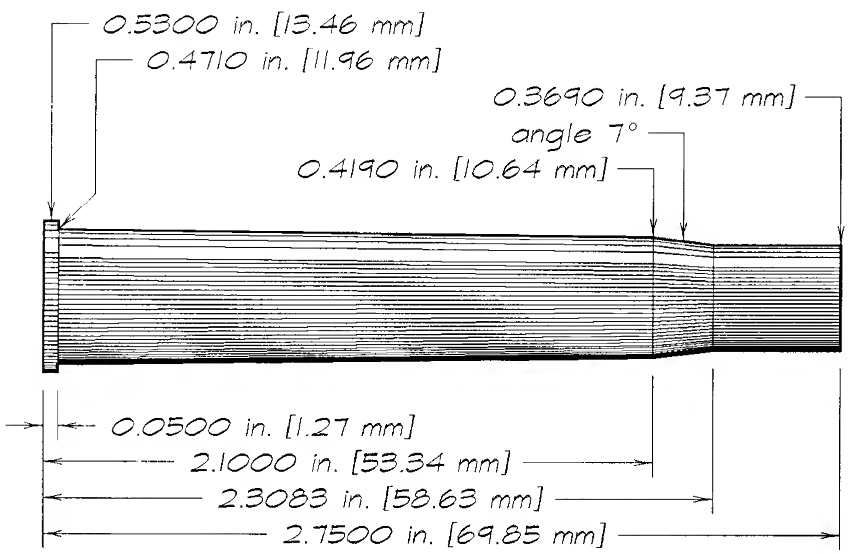
.411 bullet displaces 33.55 grains per inch.

Anneal neck and shoulder of .400-.350 NE brass. Trim to 2.6 inches. Fire-form with inert filler. Trim to 2.5 inches and deburr mouth.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.400-.338 Nitro Express (designer's specs)

solid:
872 gr brass
102 gr water

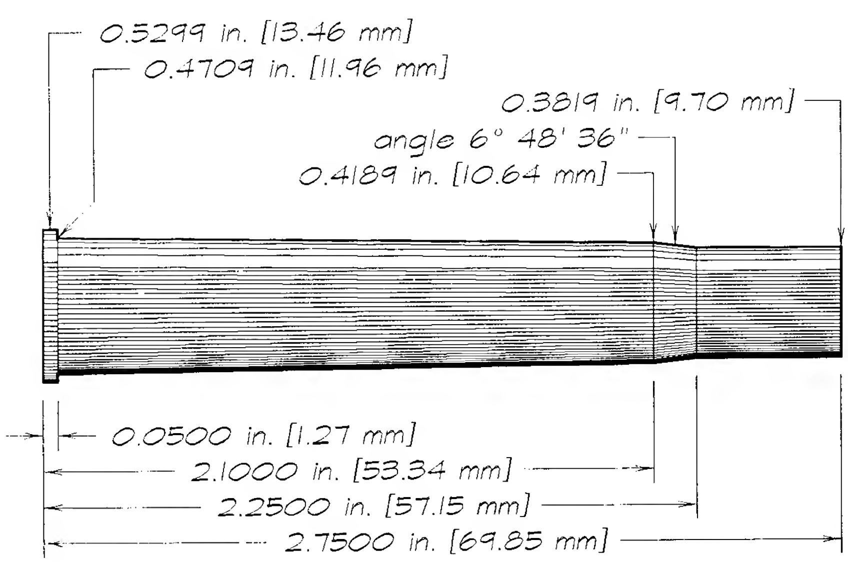


.338 bullet displaces 22.69 grains per inch.

Resize .400-.350 Nitro Express brass full-length in .400-.338 NE sizer die. Or form from .405 Basic brass, in RCBS form and trim dies. Or trim 9.3x74mm R brass to 2¾ inches, resize full-length in .400-.338 NE sizer die, and deburr.

.400-.350 Nitro Express (CIP maximums)

solid:
889 gr brass
104 gr water



.356 bullet displaces 25.17 grains per inch.

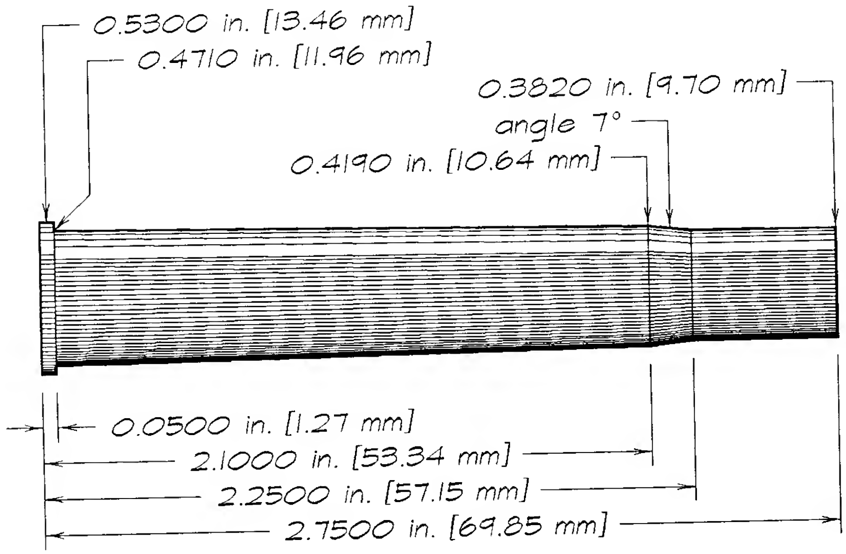
Use factory .400-.350 NE brass. Or trim 9.3x74mm Rimmed brass to 2¾ inches, deburr, and fire-form with inert filler. Or form from .405 Basic brass, in RCBS form and trim dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.400-.350 Express

(ICI Metals Ltd dwg)

solid:
890 gr brass
104 gr water



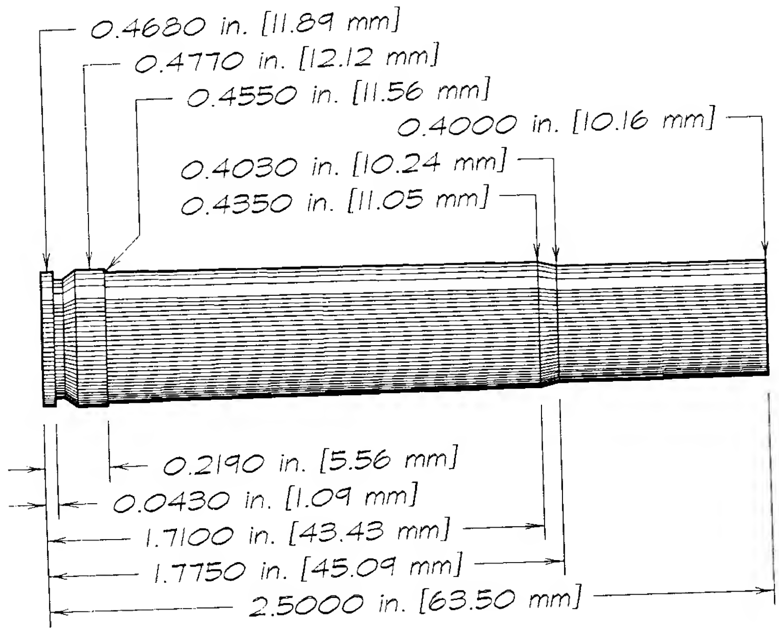
.356 bullet displaces 25.17 grains per inch.

Use recently manufactured .400-.350 brass. Or trim 9.3x74mm Rimmed brass, deburr, and fire-form with inert filler. Or form from .405 Basic brass, in RCBS form and trim dies.

.400-.375 Holland & Holland

(Birmingham Proof House)

solid:
813 gr brass
95 gr water



.375 bullet displaces 27.93 grains per inch.

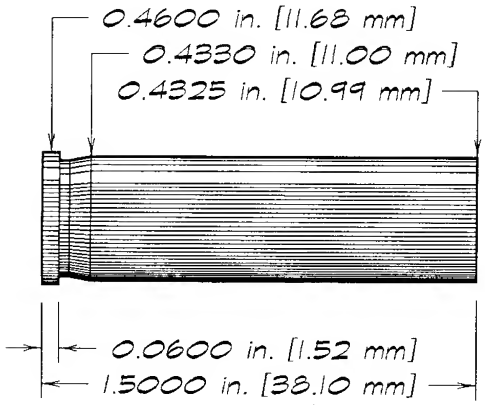
Anneal neck, shoulder, and upper body of .375 H&H Magnum brass and fire-form with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.401 Winchester Self-Loading

(SAAMI maximums, 1959)

solid:
491 gr brass
58 gr water



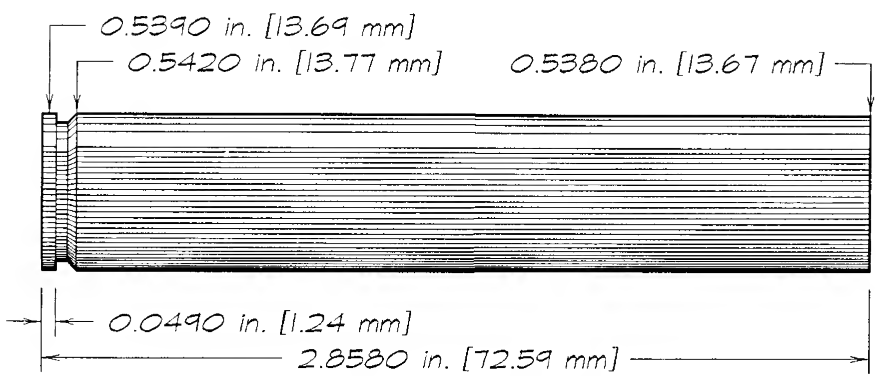
.407 bullet displaces
32.90 grains per inch.

Form from .35 Remington or .303 Savage brass, in respective RCBS form dies.

.404 HDS Basic

(HDS specimen)

solid:
1,382 gr brass
162 gr water

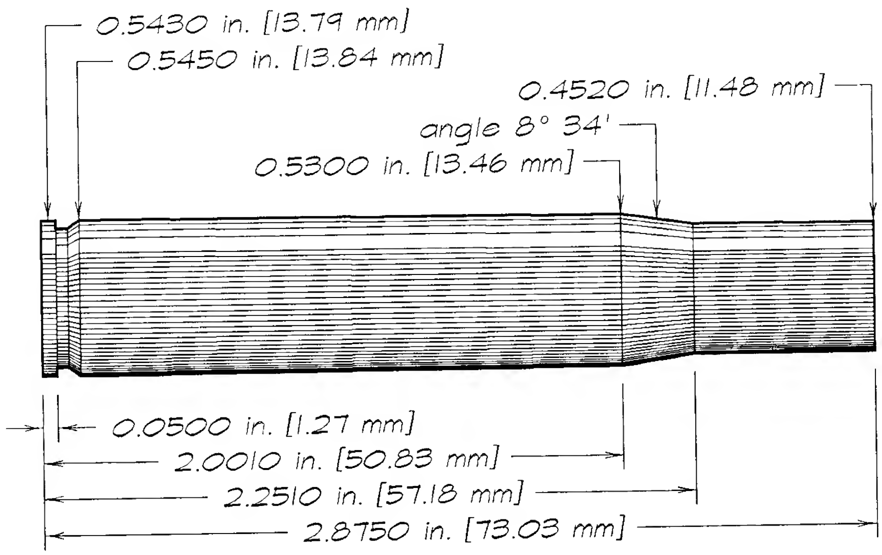


The dimensions of the rim, base, and length of this BASIC case are almost certain to be slightly different from the corresponding MAXIMUM dimensions specified for any case you plan to form from this one. Don't let the normal variation of a few ten-thousandths of an inch -- even a few thousandths -- worry you.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.404 Kynoch

(ICI Metals drawing, 1950)



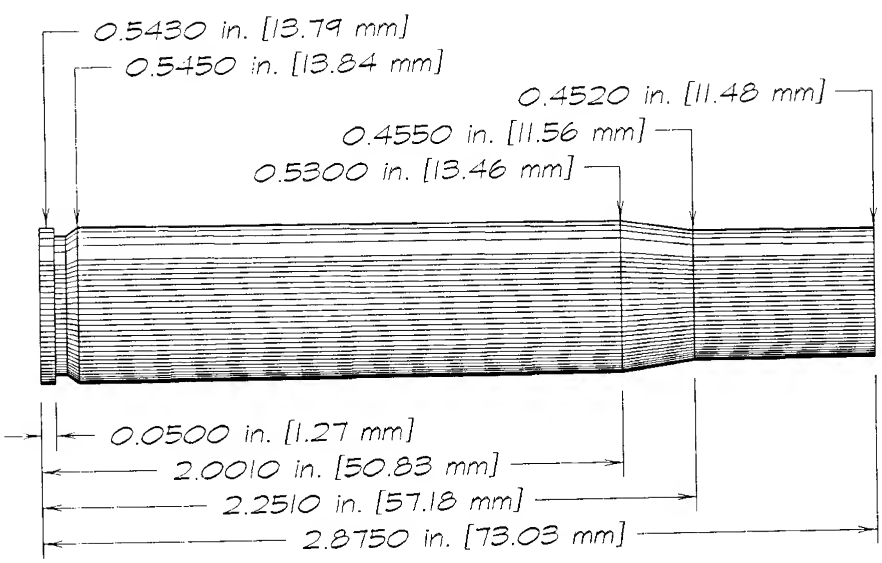
solid:
1,290 gr brass
151 gr water

.422 bullet displaces 35.37 grains per inch.

Use factory .404 Jeffery brass (same case, different name). Or form from HDS .404 Basic brass.

.404 Rimless Nitro Express (Jeffery)

(Birmingham Proof House)



solid:
1,290 gr brass
151 gr water

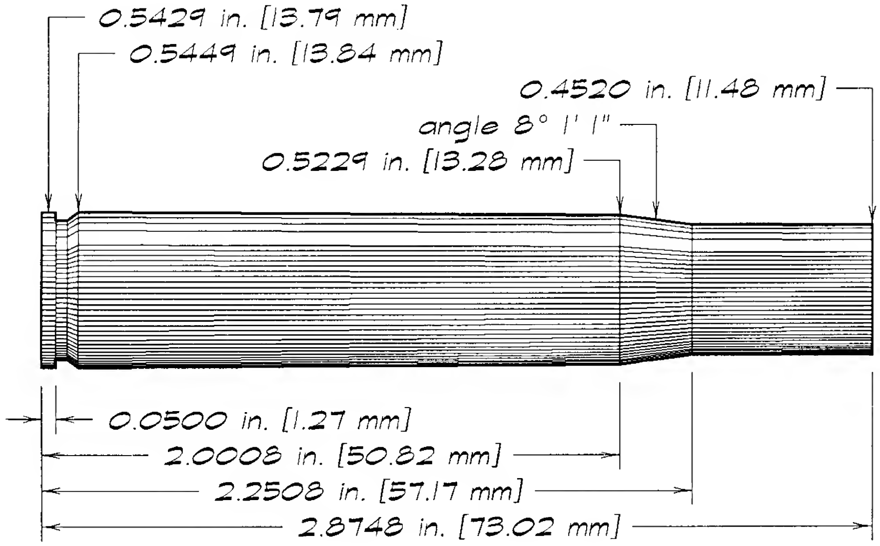
.422 bullet displaces 35.37 grains per inch.

Use recently manufactured .404 Rimless NE (.404 Jeffery) brass. No satisfactory substitute is available (wildcats based on the .404 tend to be shorter).

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.404 Rimless Nitro Express (Jeffery) (CIP maximums)

solid:
1,279 gr brass
150 gr water

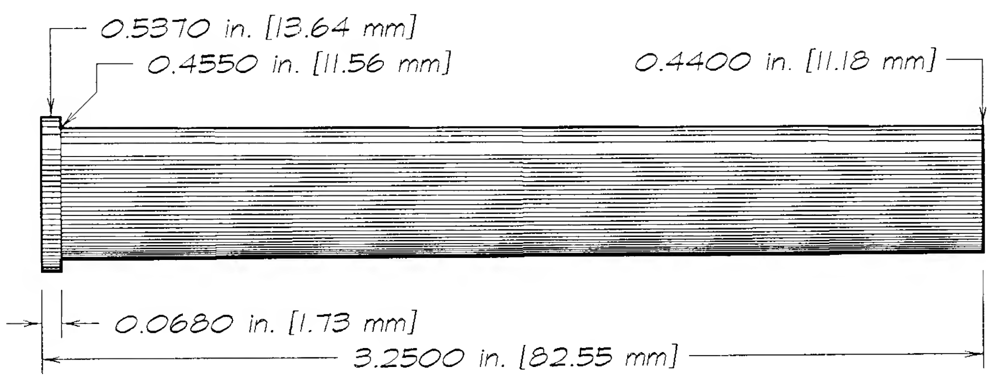


.422 bullet displaces
35.37 grains per inch.

Use recently manufactured .404 Rimless NE (.404 Jeffery) brass. No satisfactory substitute is available (wildcats based on the .404 tend to be shorter).

.405 HDS Basic (HDS specimen)

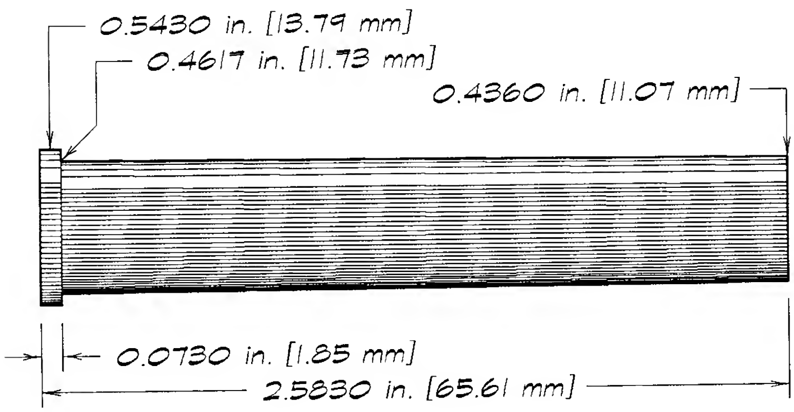
solid:
1,084 gr brass
127 gr water



The dimensions of the rim, base, and length of this BASIC case are almost certain to be slightly different from the corresponding MAXIMUM dimensions specified for any case you plan to form from this one. Don't let the normal variation of a few ten-thousandths of an inch -- even a few thousandths -- worry you.

.405 Winchester (SAAMI maximums, 1959)

solid:
880 gr brass
103 gr water

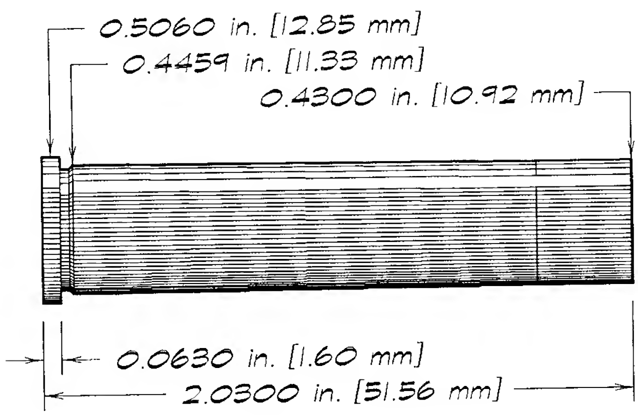


.411 bullet displaces 33.55 grains per inch.

Use recently manufactured .405 brass. Or form from .405 Basic or 9.3x74mm Rimmed brass, in respective RCBS form die.

.408 Winchester (SAAMI maximums, 1965)

solid:
671 gr brass
79 gr water



.406 bullet displaces 32.74 grains per inch.

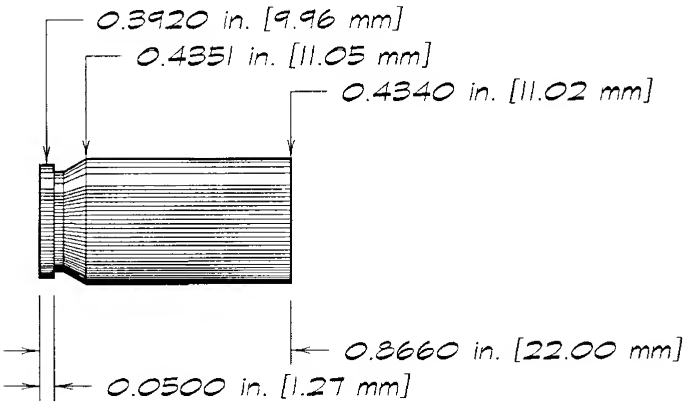
Apparently, an experimental case never marketed; included here more for collectors and historians than for handloaders. Donnelly, citing Nonte, listed this (or an alternate design, perhaps) as a belted magnum that must have been hard to distinguish from a .416 Taylor without a caliper. The SAAMI drawing of this one, approved 1 July 1965 and issued 15 September 1965, shows no later revision notes.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.41 Action Express

(SAAMI maximums)

solid:
262 gr brass
31 gr water



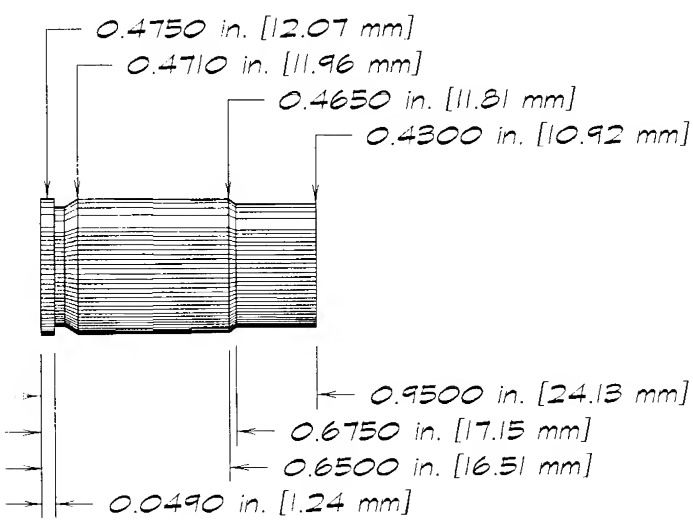
.411 bullet displaces
33.55 grains per inch.

Use factory .41 Action Express brass. Or anneal .303 Savage brass, turn heads to .41 Action Express dimensions, shorten to 0.866 inch long, ream inside mouths, and deburr.

.41 Avenger

(J D Jones specimen)

solid:
339 gr brass
40 gr water



.410 bullet displaces
33.39 grains per inch.

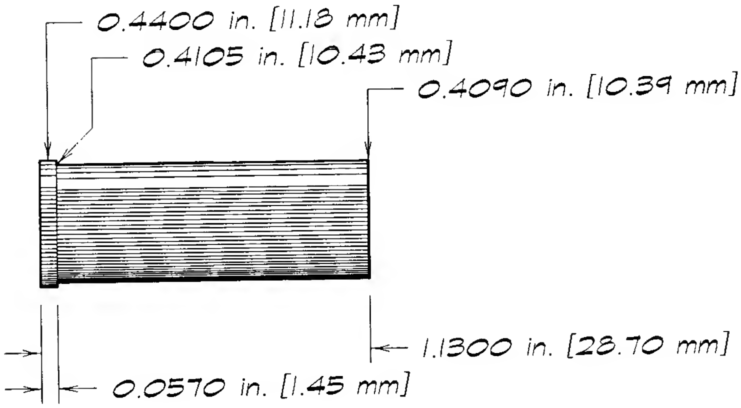
Trim .45 Winchester Magnum case to 1 inch long and size full-length in .41 Avenger sizer die. Trim to 0.95 inch and deburr. Ream neck, in RCBS ream die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.41 Long Colt

SAAMI maximums, 1959)

solid:
340 gr brass
40 gr water



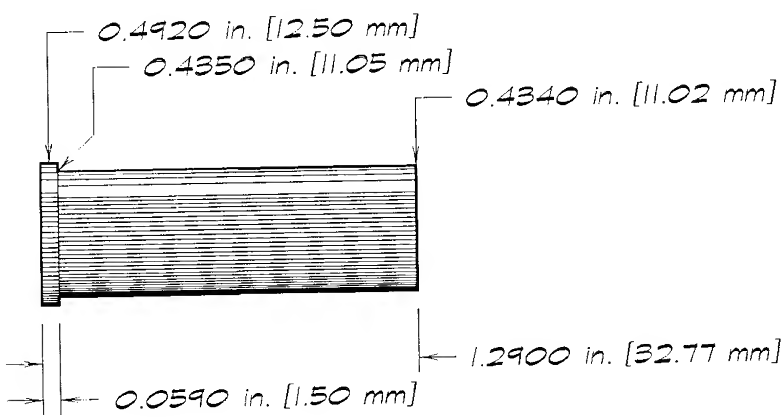
.388 bullet displaces
29.90 grains per inch.

Use recently manufactured .41 LC brass. Or form from .30-30 Winchester brass, in RCBS form dies.

.41 Remington Magnum

(SAAMI maximums)

solid:
445 gr brass
52 gr water



.410 bullet displaces
33.39 grains per inch.

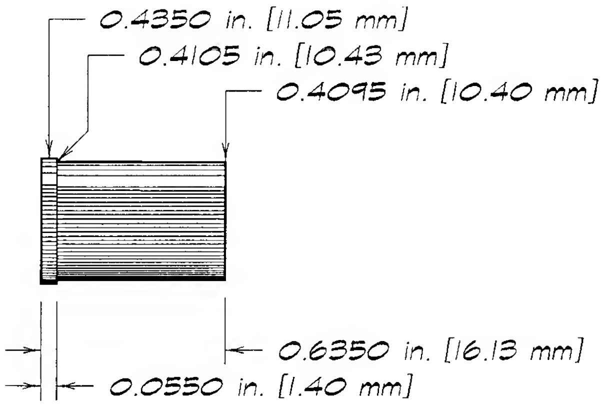
Use factory .41 Magnum brass. Or anneal .303 Savage brass, shorten to 1.3 inches long, ream inside mouth if necessary, deburr, and fire-form with inert filler or moderate load.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.41 Short Colt

(Winchester drawing, 1912)

solid:
187 gr brass
22 gr water

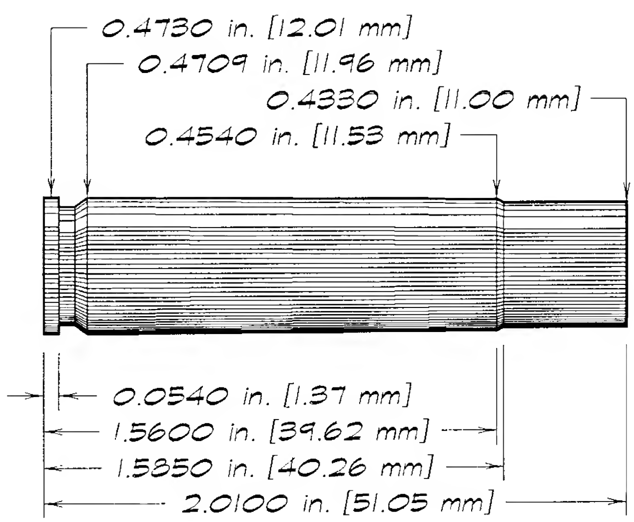


No substitute available

.41-08 Davis

(designer's specs)

solid:
714 gr brass
84 gr water



.411 bullet displaces 33.55 grains per inch.

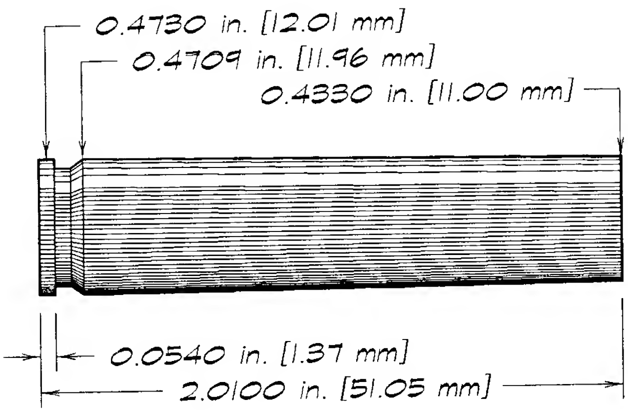
Anneal neck, shoulder, and upper body of .308 Winchester brass. Fire-form with inert filler (in fire-forming fixture).

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.411 Davis Hawg

(designer's specs)

solid:
710 gr brass
83 gr water



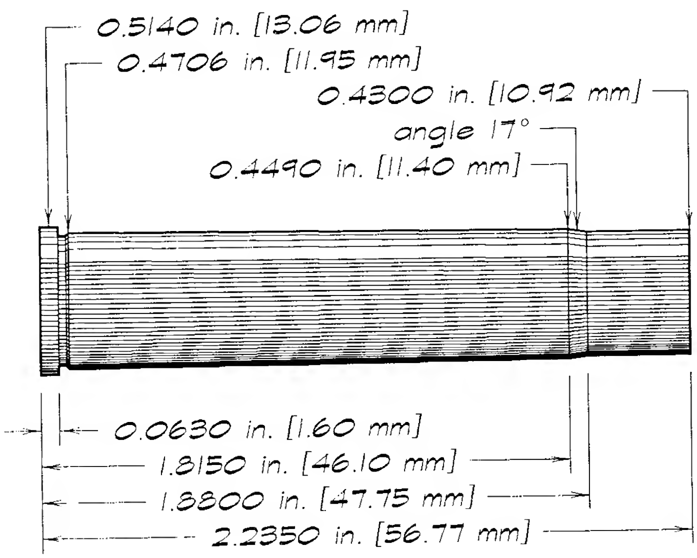
.411 bullet displaces
33.55 grains per inch.

Anneal neck, shoulder, and upper body of .308 Winchester brass. Fire-form with inert filler (in fire-forming fixture).

.411 JDJ

(J D Jones specimen)

solid:
828 gr brass
97 gr water



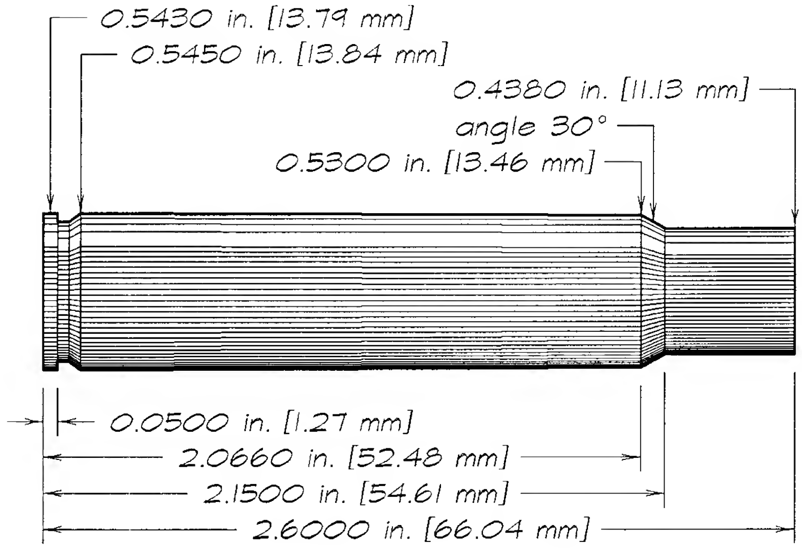
.409 bullet displaces
33.22 grains per inch.

Resize .444 Marlin brass full-length in .411 JDJ sizer die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.411 Jensen Magnum (designer's specs)

solid:
1,186 gr brass
139 gr water

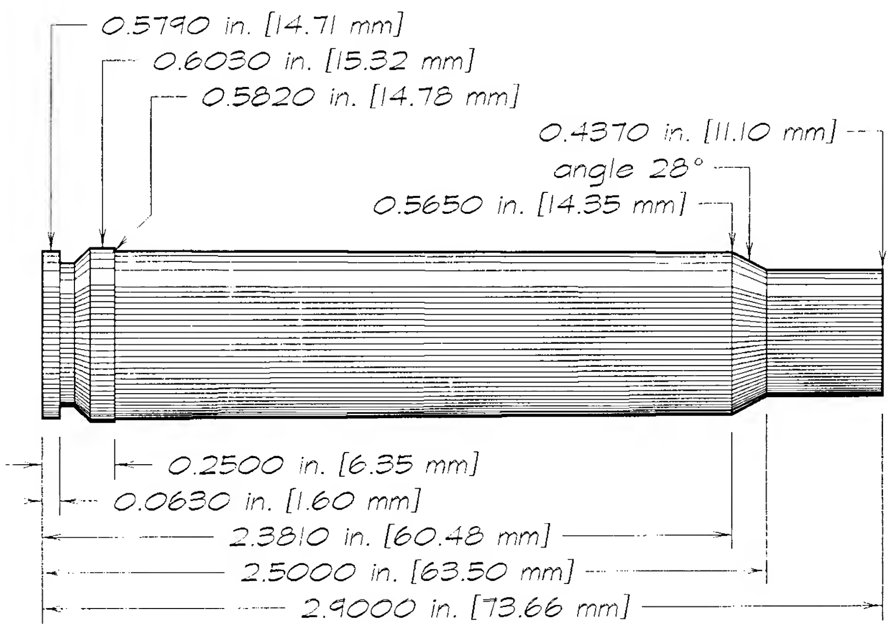


.409 bullet displaces
33.22 grains per inch.

Anneal neck and shoulder of .404 Jeffery or HDS .404 Basic brass. Form and trim, in RCBS form and trim dies. Ream inside neck, in RCBS neck-ream die. Deburr. Fire-form with inert filler.

.411 Torok (A-Square maximums)

solid:
1,537 gr brass
180 gr water



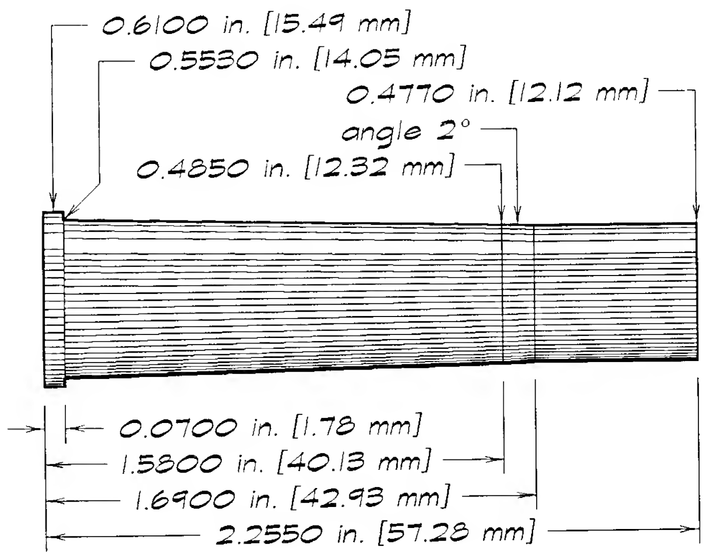
.409 bullet displaces
33.22 grains per inch.

Use A-Square or A-Cube factory brass. Or fire-form .378 Weatherby Magnum brass with inert filler. Or resize .460 Weatherby Magnum brass full-length in .411 Torok sizer die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.416 Alaskan (David J LeGate)

solid:
1,013 gr brass
119 gr water

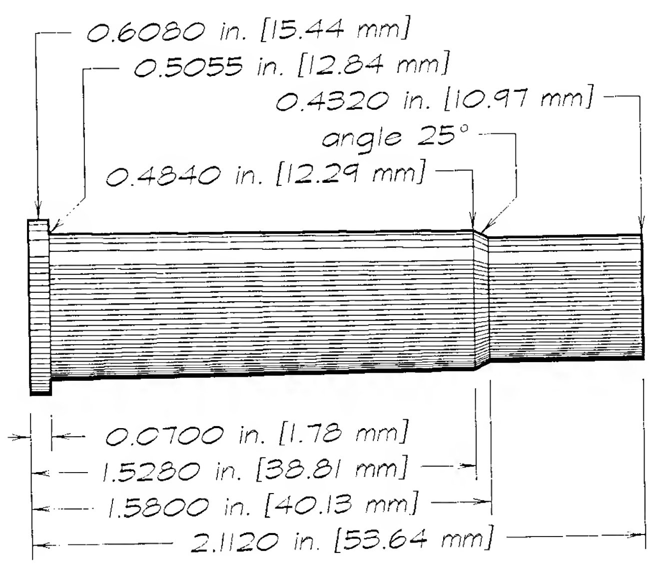


.416 bullet displaces 34.37 grains per inch.

Anneal neck, shoulder, and upper body of new, unfired .348 Winchester brass and fire-form with inert filler.

.416 Barnes (designer's specs)

solid:
836 gr brass
98 gr water



.416 bullet displaces 34.37 grains per inch.

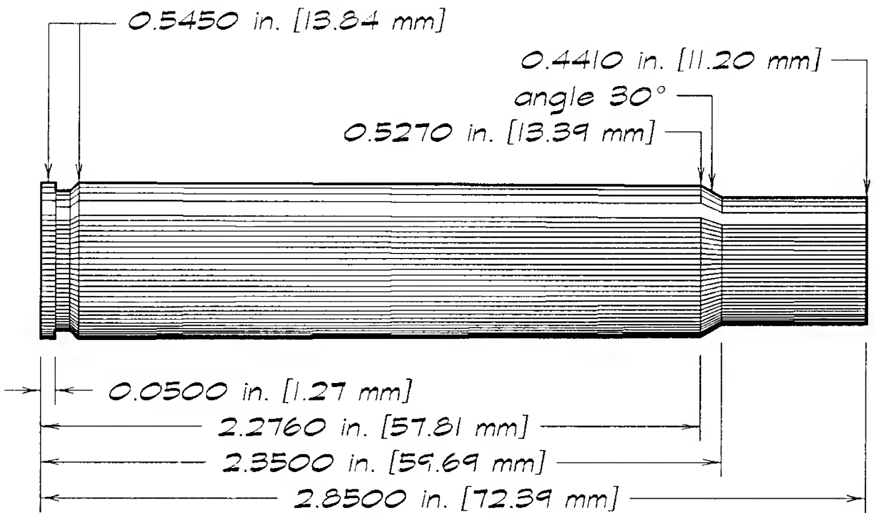
Resize .45-70 Government brass full-length in .416 Barnes sizer die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.416 Dakota

(Dakota Arms drawing)

solid:
1,294 gr brass
152 gr water



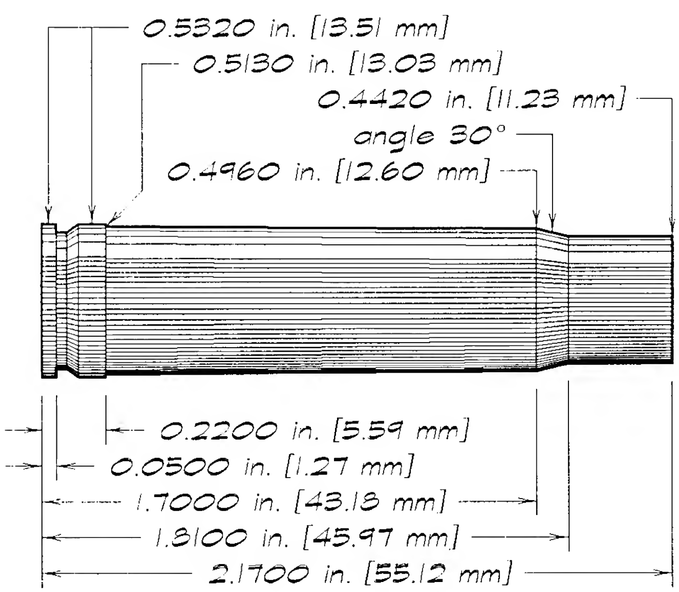
.416 bullet displaces
34.37 grains
per inch.

Size .404 Jeffery case full-length, trim to length, and deburr mouth.

.416 Express (Waters)

(Ken Waters)

solid:
915 gr brass
107 gr water



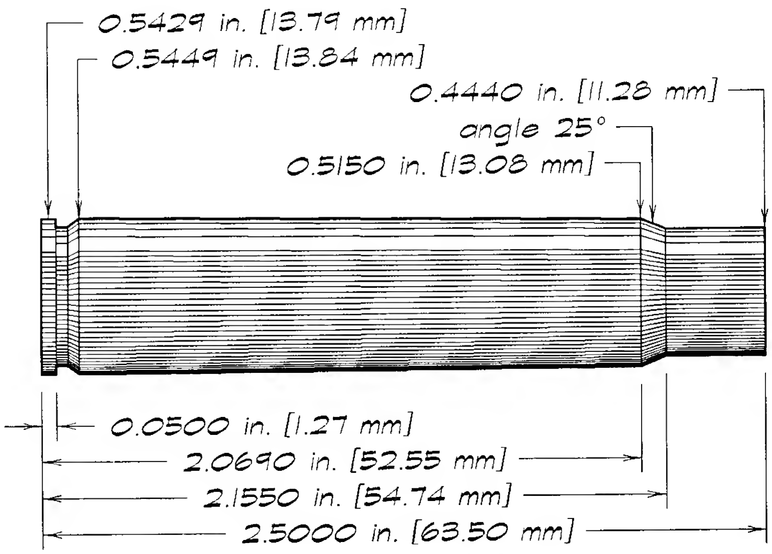
.416 bullet displaces
34.37 grains per inch.

Fire-form .350 Remington Magnum brass with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.416 Howell (designer's specs)

solid:
1,050 gr brass
123 gr water

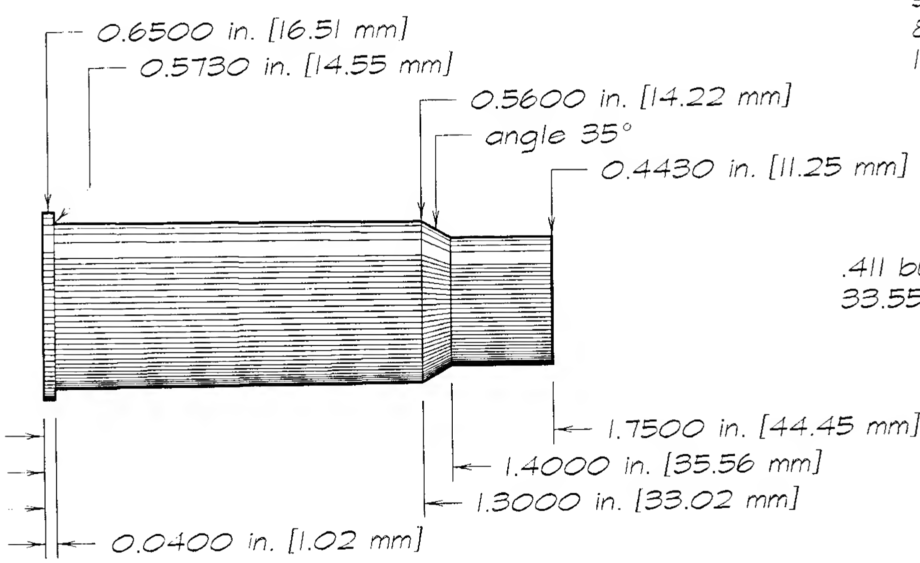


.416 bullet displaces 34.37 grains per inch.

Anneal neck and shoulder of .404 Jeffery brass. Form in RCBS .416 Howell form-and-trim die. Ream inside neck with RCBS neck-ream set. Trim to 2½ inches and deburr. Fire-form with inert filler.

.416 Jurras (Jurras drawing)

solid:
889 gr brass
104 gr water

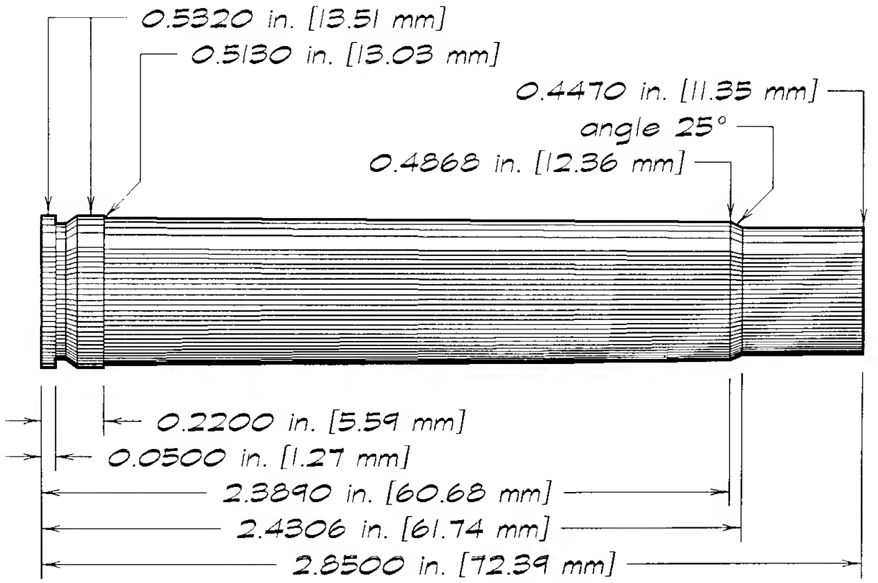


.411 bullet displaces 33.55 grains per inch.

Anneal upper body of .500 Nitro Express brass. Form and trim in RCBS form-and-trim die. Ream inside neck, in RCBS neck-ream set. Fire-form with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.416 Remington Magnum (SAAMI maximums)

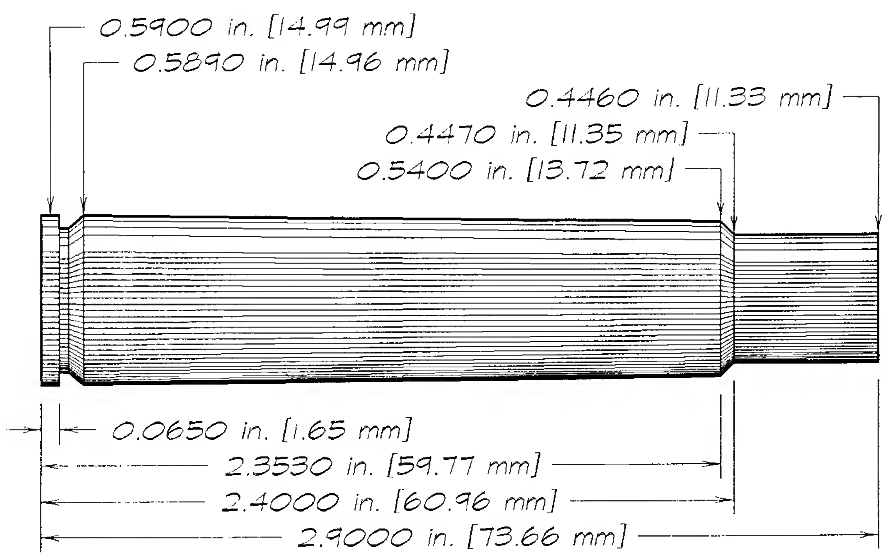


solid:
1,209 gr brass
142 gr water

.416 bullet displaces 34.37 grains per inch.

Use factory-made .416 Remington Magnum brass. Or fire-form .375 H&H Magnum cases with inert filler.

.416 Rigby (Birmingham Proof House)



solid:
1,490 gr brass
175 gr water

.416 bullet displaces 34.37 grains per inch.

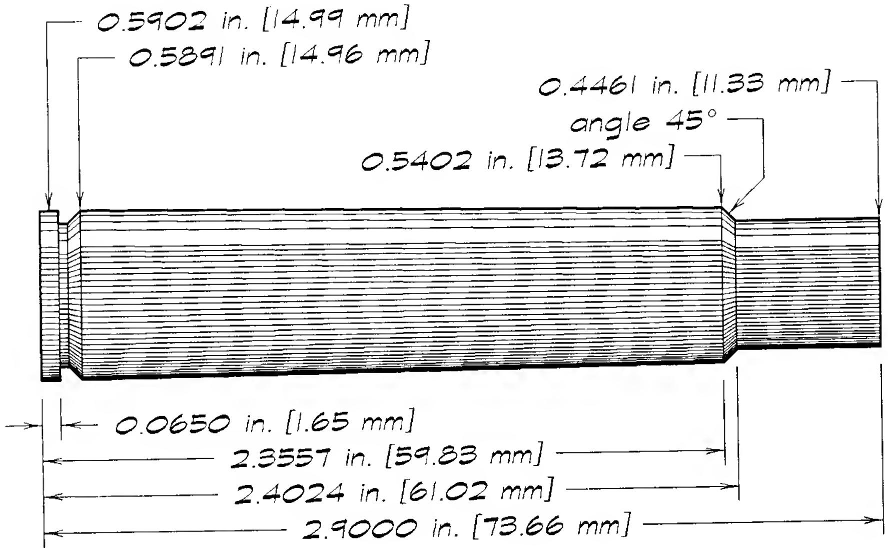
Use factory .416 Rigby brass. Or turn belt off .378 or .460 Weatherby Magnum brass and form in the respective RCBS form die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.416 Rigby

(SAAMI maximums)

1,492 gr brass
175 gr water



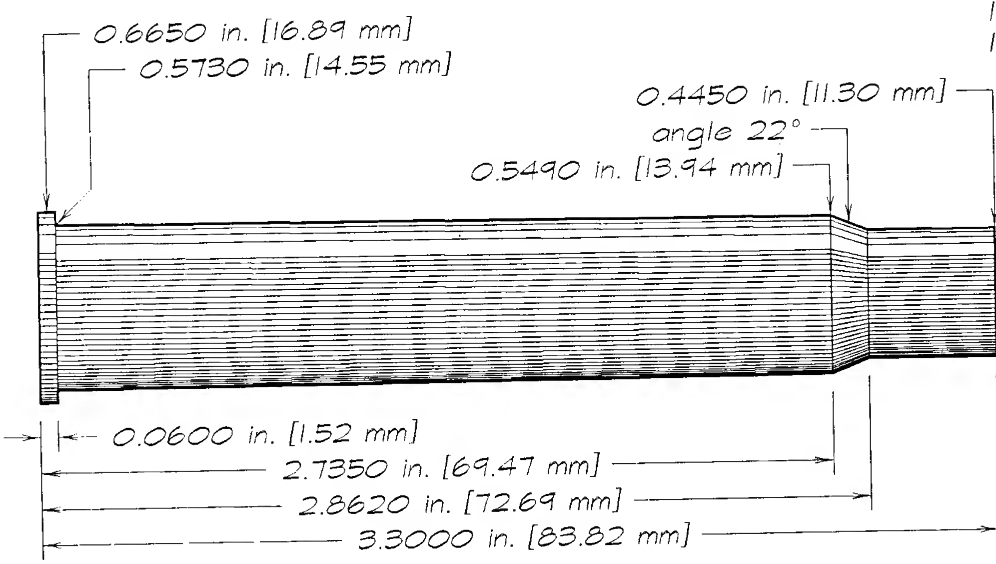
.416 bullet displaces 34.37 grains per inch.

Use factory-made .416 Rigby cases. Or turn belts off .378 or .460 Weatherby Magnum brass and form in respective RCBS form die.

.416 Rimmed Chapuis ("shop-WEE")

(A-Square maximums)

solid model:
1,611 gr brass
189 gr water



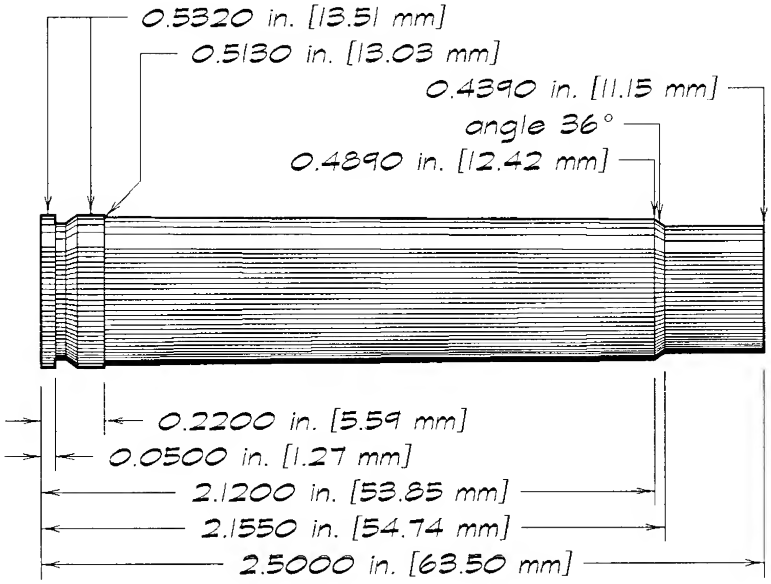
.416 bullet displaces 34.37 grains per inch.

Use A-Square or A-Cube .416 R Chapuis brass.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.416 Taylor (David J LeGate)

solid:
1,065 gr brass
125 gr water

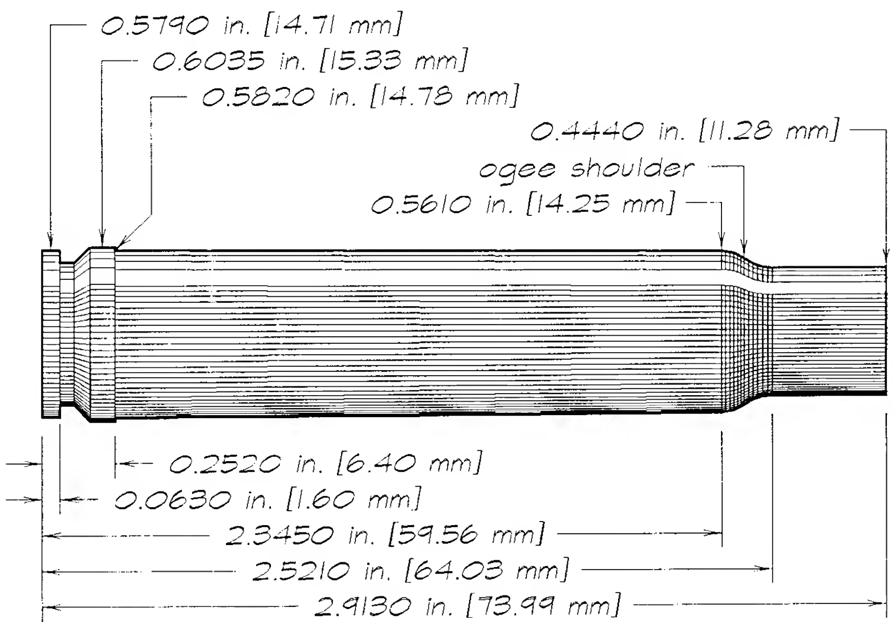


.416 bullet displaces 34.37 grains per inch.

Resize .458 Winchester Magnum brass full-length in .416 Taylor sizer die. Or anneal neck and shoulder of .338 Winchester Magnum brass and fire-form with inert filler.

.416 Weatherby Magnum (Weatherby drawing)

solid:
1,538 gr brass
180 gr water

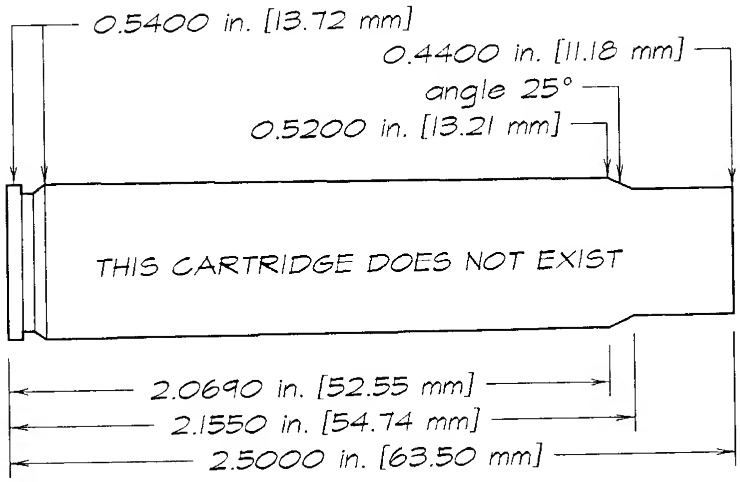


.416 bullet displaces 34.37 grains per inch.

Use factory .416 Weatherby Magnum brass. Or resize .460 Weatherby Magnum brass full-length in .416 Weatherby Magnum sizer die. Or fire-form .378 Weatherby Magnum brass with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

".416 Winchester Express" (designer's first specs)

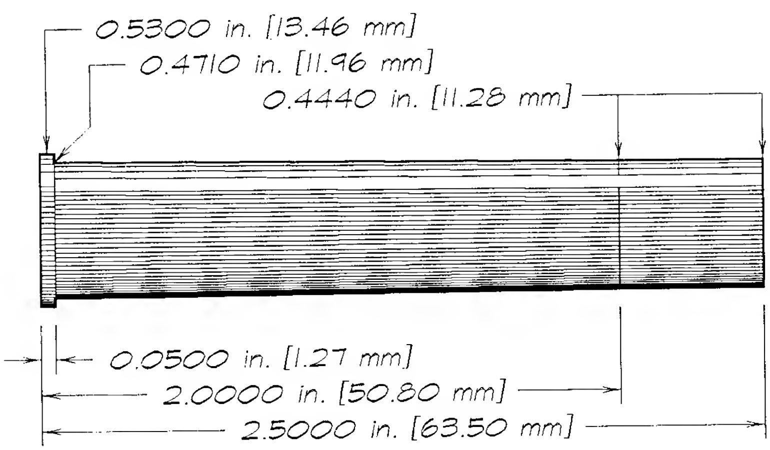


I have to include this old drawing to point out the error of its having been published in another book by mistake. It's the first version of a cartridge I designed for Winchester in 1979. After our art director, Dave LeGate, made this drawing for my report to Winchester, we found that some of my dimensions were wrong. Dave redrew the case but didn't throw away the old drawing.

After Dave's death, the old .416 Winchester Express drawing in his files apparently had nothing to identify it as a throw-away, so it found its way into a posthumously published collection of his cartridge drawings.
Olin Corporation sold the Winchester plant to U S Repeating Arms Company before the .416 Winchester Express -- by then drastically different from my original design -- was developed. My version became the .416 Howell.

.416-06 Rimmed (designer's specs)

solid:
888 gr brass
104 gr water



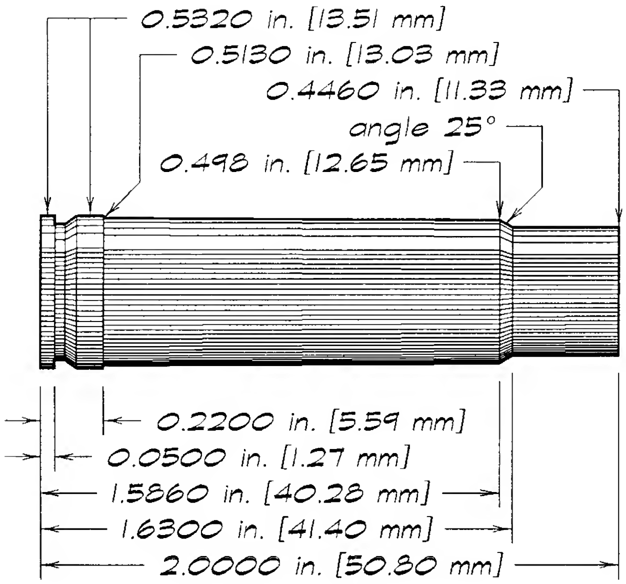
.416 bullet displaces 34.37 grains per inch.

Anneal neck and shoulder of .400-.350 NE brass. Trim to 2.6 inches. Fire-form with inert filler. Trim to 2.5 inches and deburr.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.416 2-Inch (10.6x51mm) (David J LeGate)

solid:
844 gr brass
99 gr water

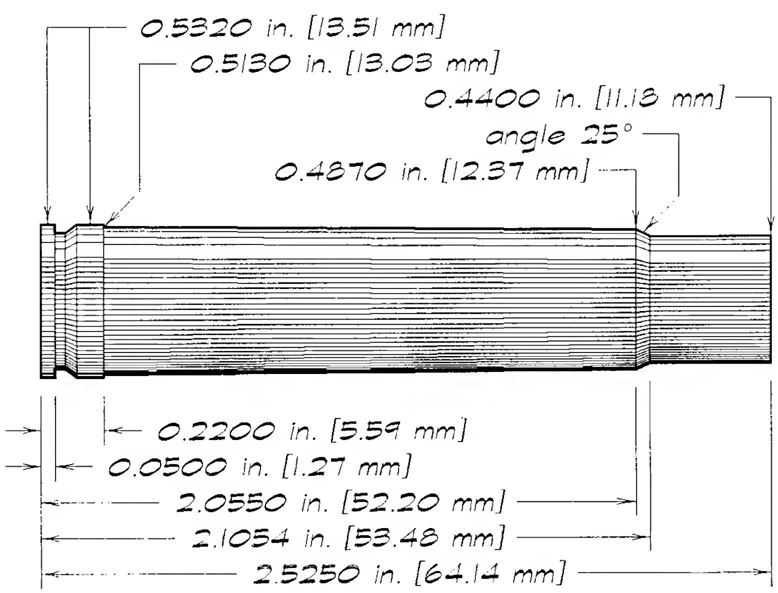


.416 bullet displaces
34.37 grains per inch.

Resize .458 Winchester Magnum brass full-length in 10.6x51mm sizer die. Trim to 2.000 inches, ream inside necks, and deburr.

.416-.338 Winchester Magnum (David J LeGate)

solid:
1,064 gr brass
125 gr water



.416 bullet displaces
34.37 grains per inch.

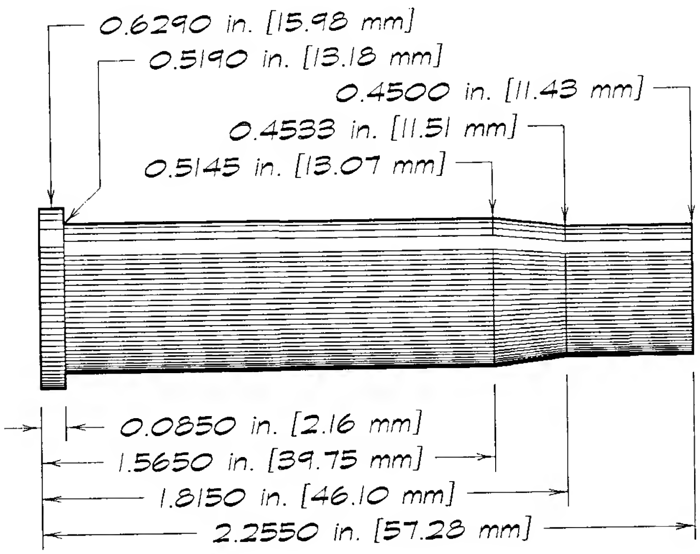
Resize .458 Winchester Magnum brass full-length in .416-.338 sizer die. Or fire-form .338 Winchester Magnum brass with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.42 Russian

(Winchester drawing, 1912)

solid:
986 gr brass
116 gr water



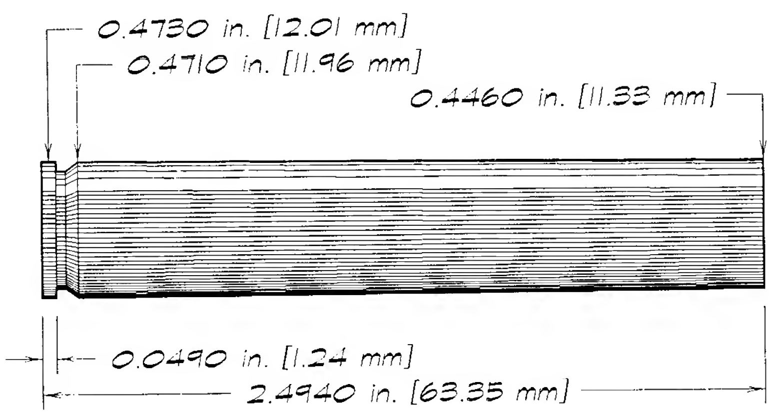
.435 bullet displaces 37.58 grains per inch.

Form from Huntington .45 Basic brass (.45-70 Springfield works, too, but is a little short of full length), in RCBS form dies.

.423 OKH

(C M O'Neil specimen)

solid:
893 gr brass
105 gr water



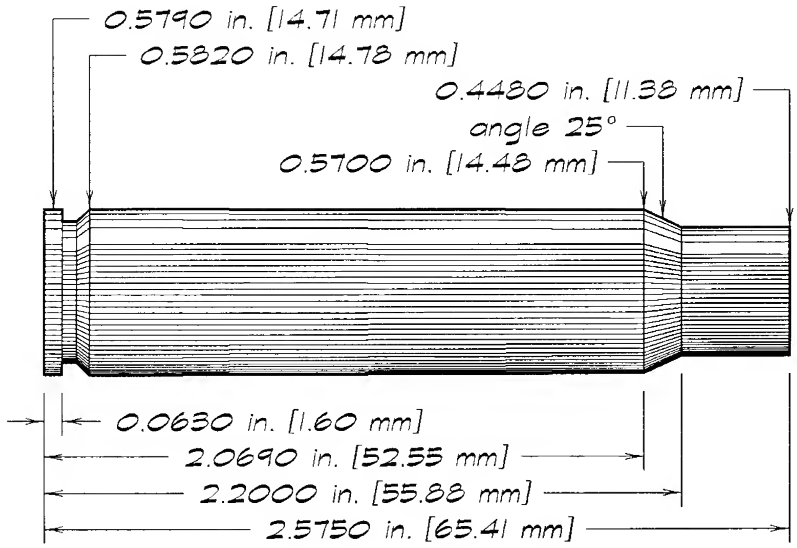
.423 bullet displaces 35.54 grains per inch.

REQUIRES A SPECIAL CHAMBER with an annular lip to maintain headspace on the mouth of the case. (Charles M O'Neil made only a handful of rifles for his intriguing little .423 OKH. His .424 OKH is a belted H&H case.)
Anneal neck and shoulder of .35 Whelen brass. Fire-form with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.423 Van Horn Nitro (designer's specs)

solid:
1,233 gr brass
145 gr water

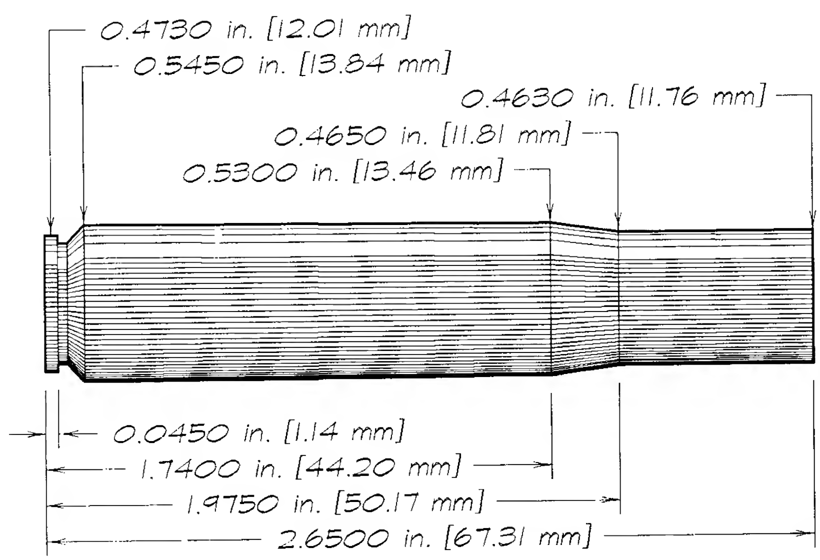


.423 bullet displaces
35.54 grains per inch.

Turn belt off .460 Weatherby Magnum or .378 Weatherby Magnum brass. Anneal neck, shoulder, and upper body. Form and trim in RCBS form and trim dies. Ream inside neck, in RCBS neck-ream die. Deburr.

.425 Westley Richards (Birmingham Proof House)

solid:
1,177 gr brass
138 gr water



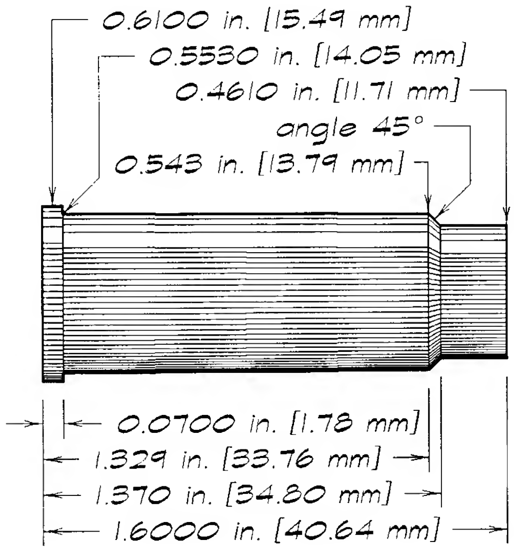
.435 bullet displaces
37.58 grains per inch.

Use factory .425 Westley Richards brass. Or form from .425 WR Basic brass, in RCBS form-and-trim die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.429 Davis Extra Magnum

(designer's specs)



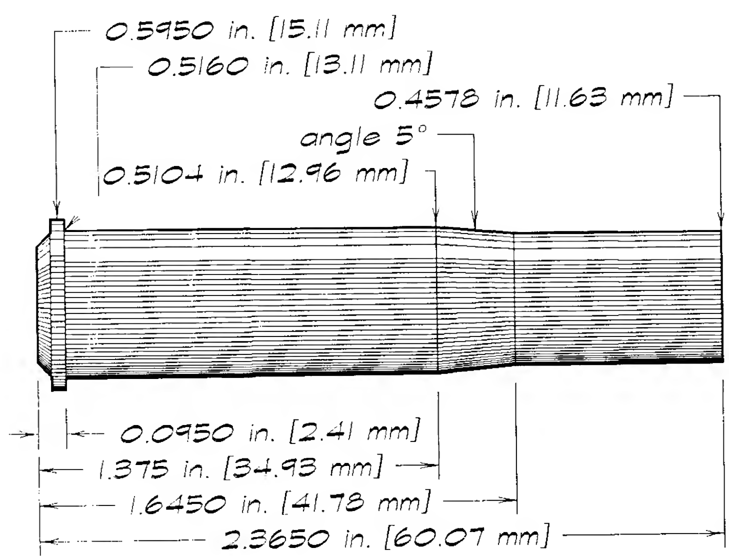
solid:
838 gr brass
98 gr water

.429 bullet displaces
36.55 grains per inch.

Anneal neck, shoulder, and upper body of .348 Winchester brass. Resize full-length in body of .429 DEM sizer die (with expander assembly removed). Fire-form with inert filler. Trim and deburr. Ream inside neck if necessary.

.43 Mauser

(Winchester drawing, 1912)



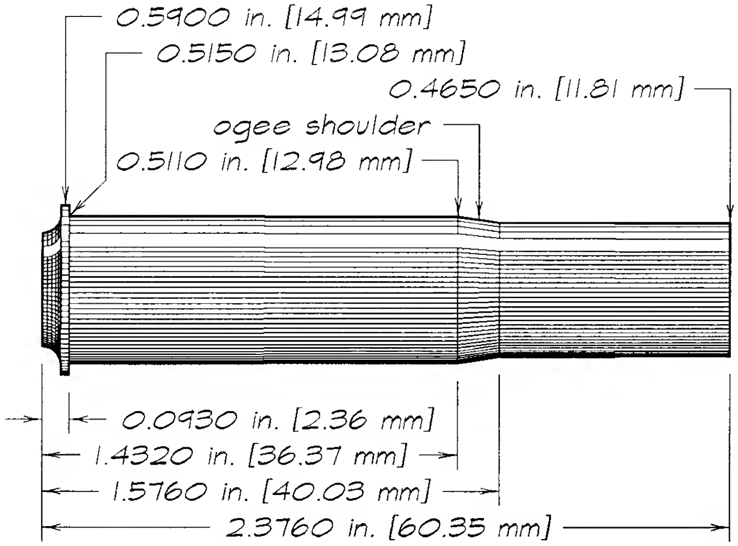
solid:
1,000 gr brass
117 gr water

.433 bullet displaces
37.24 grains per inch.

Use recently manufactured .43 Mauser brass. Or form from .43 Mauser Basic brass, in RCBS form and trim dies.

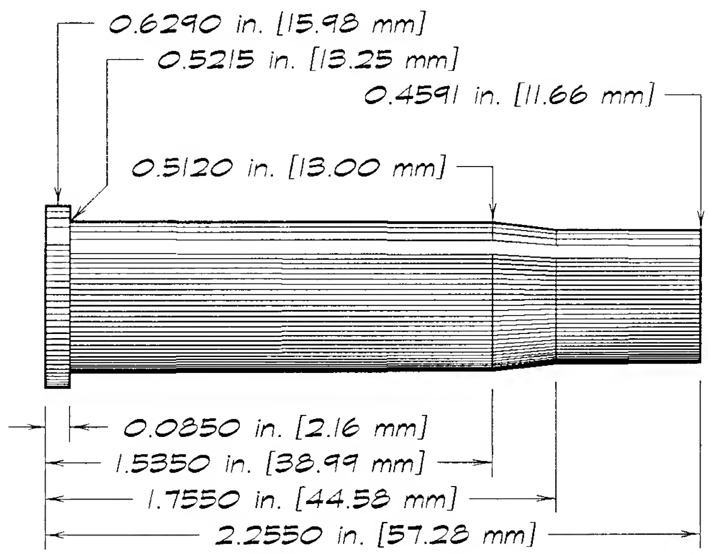
Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.43 Mauser (Prussian gov't pattern) (Kynoch drawing, 1884)



solid:
1,031 gr brass
121 gr water

.43 Spanish (Winchester drawing, 1912)



solid:
983 gr brass
115 gr water

.439 bullet displaces
38.28 grains per inch.

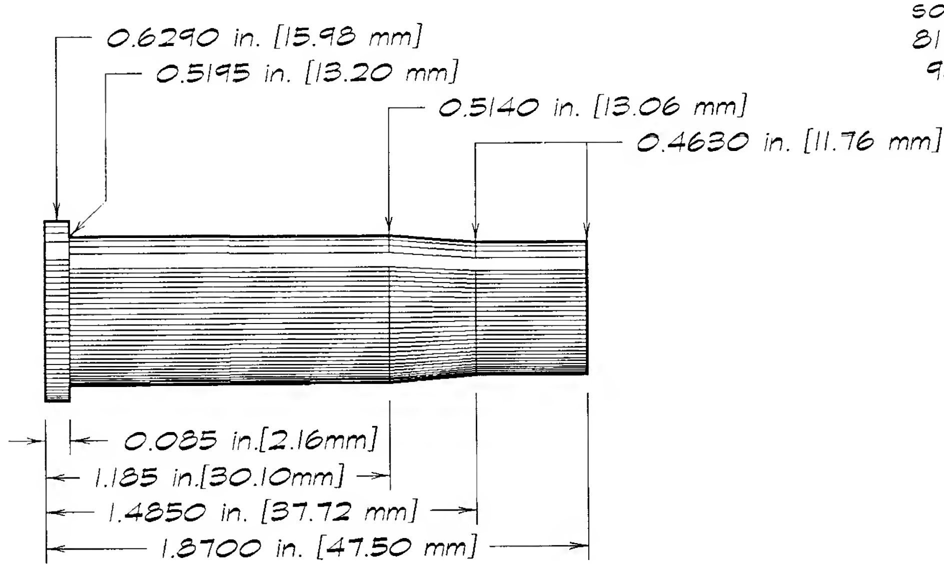
Use recently manufactured .43 Spanish brass. Or form from either .43 Mauser or .43 Spanish Basic brass, in respective RCBS form-and-trim die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.43 Spanish Carbine

(Winchester drawing, 191?)

solid:
817 gr brass
96 gr water

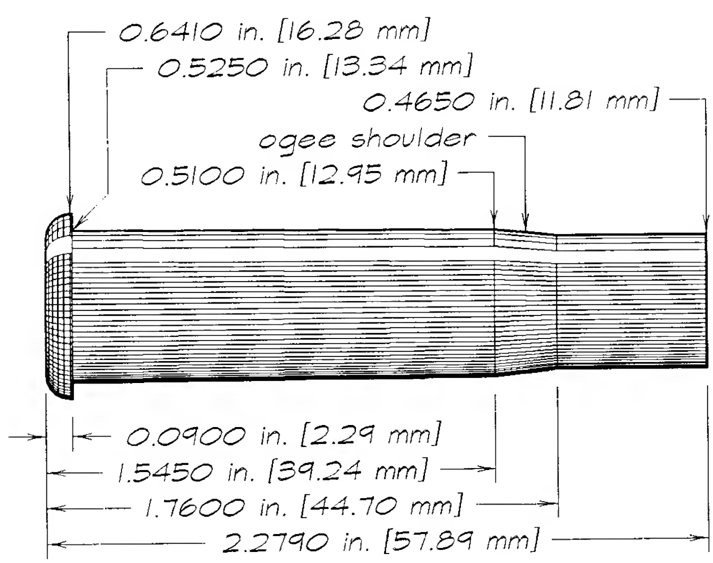


Form from .43 Spanish brass, in RCBS form-and-trim die.

.43 Remington (Spanish gov't pattern)

(Kynoch drawing, 1884)

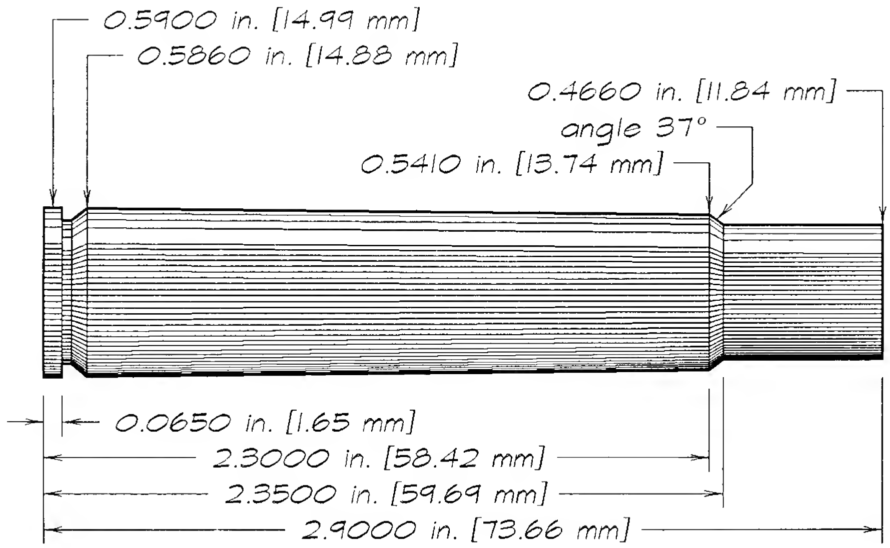
solid:
1,010 gr brass
118 gr water



Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.430 Gibbs Nitro (Kynoch drawing, 1913)

solid:
1,498 gr brass
176 gr water

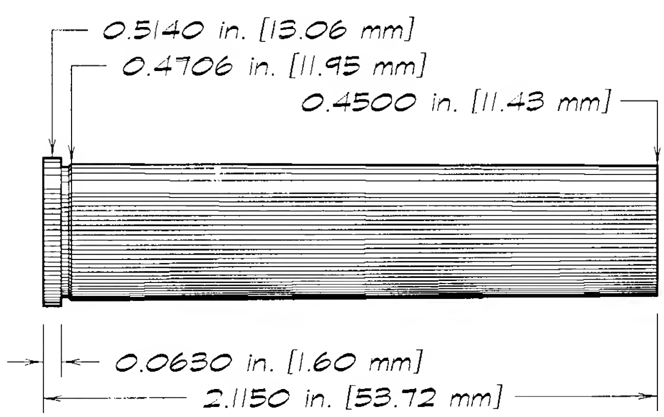


.435 bullet displaces 37.58 grains per inch.

Resize .416 Rigby brass full-length in .430 Gibbs sizer die.
Fire-form with inert filler.

.430 JDJ (J D Jones specimen)

solid:
817 gr brass
96 gr water



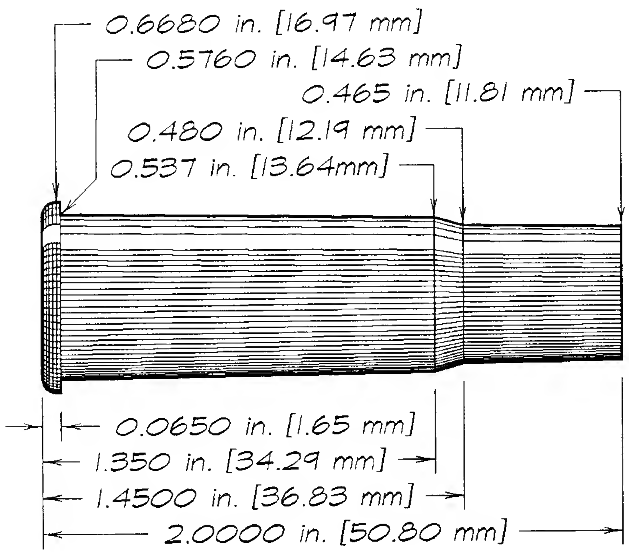
.430 bullet displaces 36.72 grains per inch.

Trim .444 Marlin brass to 2.115 inches and deburr. Resize full-length in .430 JDJ sizer die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.434 Seelun

(Kynoch drawing, 1901)



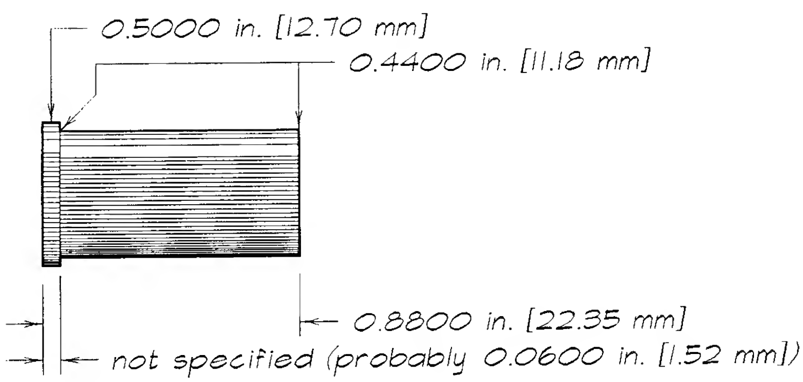
solid:
963 gr brass
113 gr water

Paper-patched .433 bullet displaces 38.45 grains per inch (outside diameter of paper patch: 0.440).

.44 S&W American

(David J LeGate)

solid:
315 gr brass
37 gr water



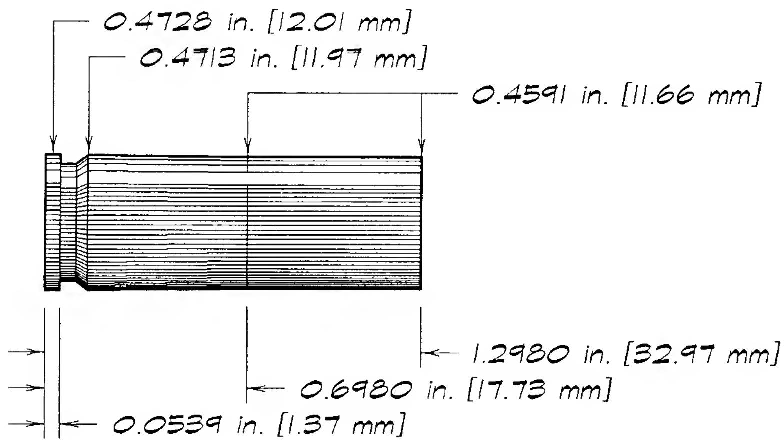
Heeled .440 bullet

With RCBS taper-expander die, expand .41 Magnum cases to form slight bulge at base. Form and trim, in RCBS trim die. Deburr.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.44 Auto Mag Pistol (Triebel maximums)

solid:
463 gr brass
54 gr water

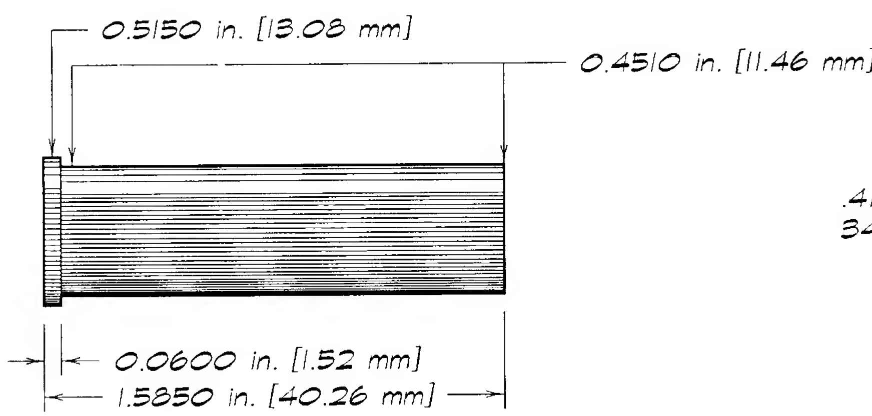


.430 bullet displaces
36.72 grains per inch.

Anneal upper body of .308 Winchester (preferred) or .30-06 Springfield brass. Form and trim in RCBS form dies. Deburr.

.44 Evans, New Model (Winchester drawing, 1912)

solid:
571 gr brass
67 gr water



.419 bullet displaces
34.87 grains per inch.

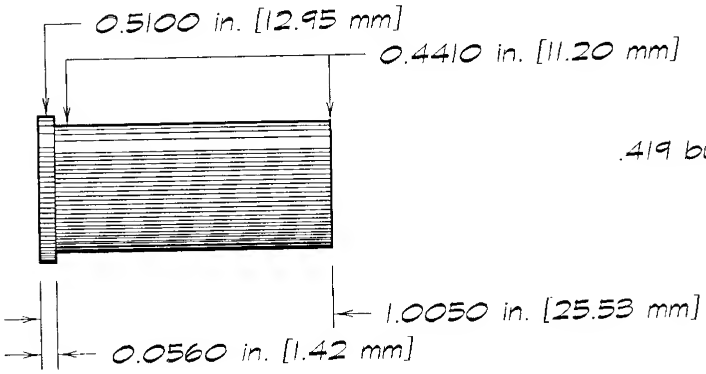
Turn rim of .303 British to 0.515 inch diameter. Trim case to 1.6 inch long. Fire-form with inert filler. Ream inside neck, trim to final length, and deburr.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.44 Evans, Old Model

(Winchester drawing, 1912)

solid:
357 gr brass
42 gr water



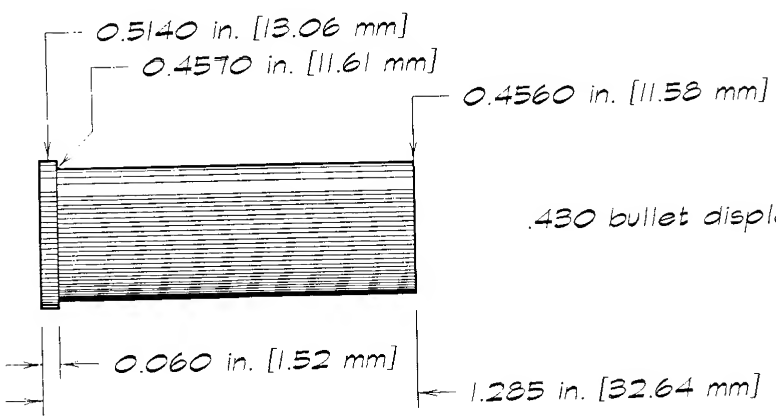
.419 bullet displaces 34.87 gr/in.

Cut .303 British case to 1.1 inch. Protect head of case from heat; anneal forward half. Fire-form with inert filler. Trim to length and deburr mouth.

.44 Remington Magnum

(SAAMI maximums)

solid:
484 gr brass
57 gr water



.430 bullet displaces 36.72 grains per inch.

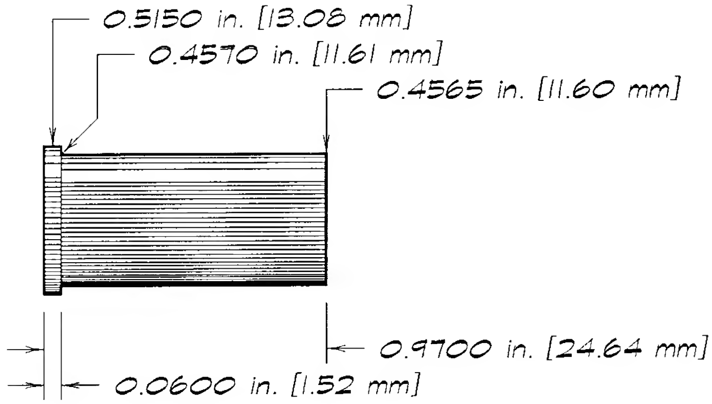
Use factory-made .44 Magnum brass. (Option: use .44 Special brass for reduced loads. Seat bullets out to reduce bullet jump.) Or, with more work than it's likely to be worth, modify .444 Marlin, .30-40 Krag, or .303 British brass.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.44 S&W Russian

(SAAMI maximums, 1965)

solid:
368 gr brass
43 gr water



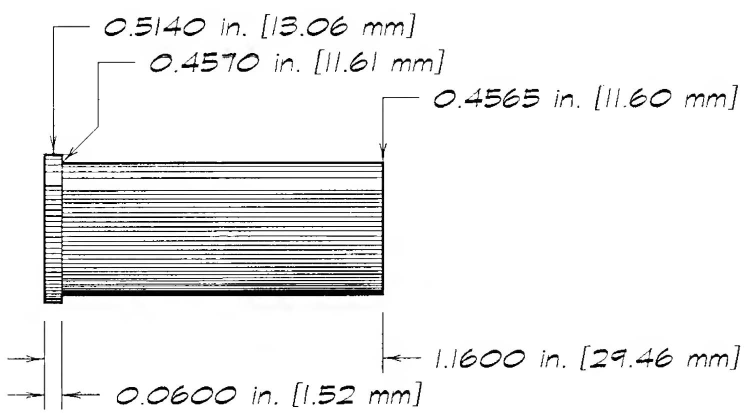
.432 bullet displaces
37.07 grains per inch.

Trim Remington .44 Special or .44 Magnum brass to length and deburr mouth.

.44 Smith & Wesson Special

(SAAMI maximums)

solid:
437 gr brass
51 gr water



.432 bullet displaces
37.07 grains per inch.

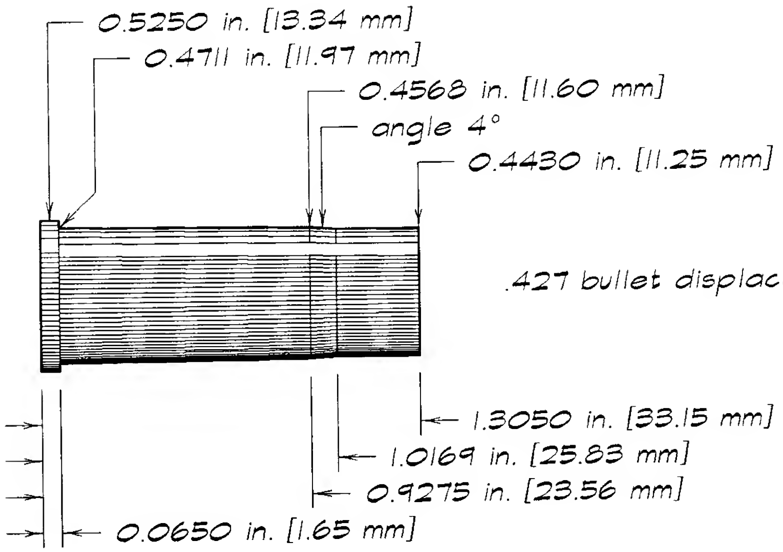
Use factory .44 Special brass. Or shorten .44 Magnum brass to 1.16 inches and deburr mouths.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.44-40 Winchester (.44 WCF)

(SAAMI maximums)

solid:
487 gr brass
57 gr water



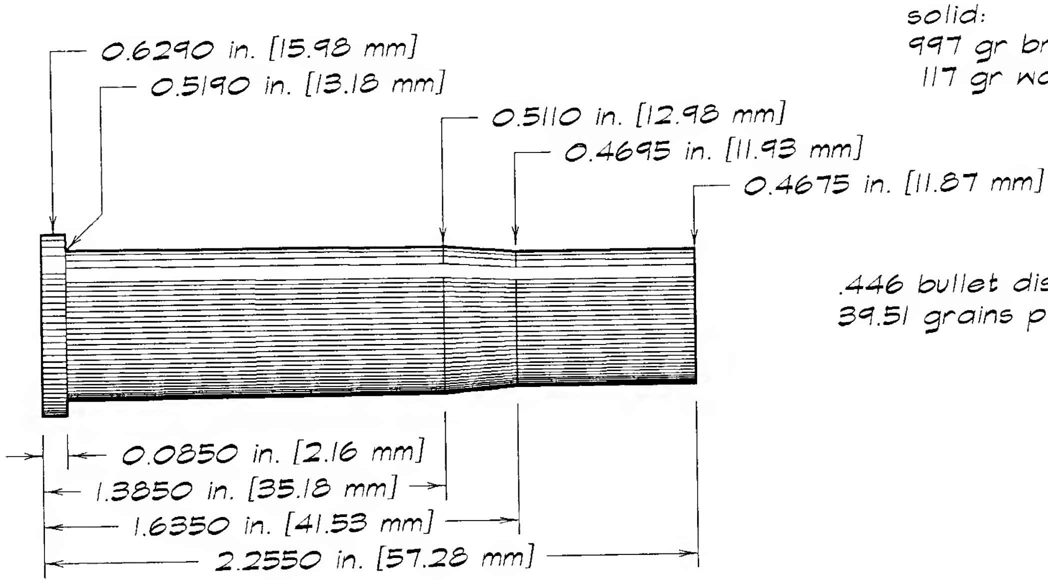
.427 bullet displaces 36.21 grains per inch.

Use recently manufactured .44-40 Winchester brass. Or fire-form new .38-40 Winchester brass with inert filler.

.44-77 Sharps (.44-77 Remington)

(Winchester drawing, 1912)

solid:
997 gr brass
117 gr water



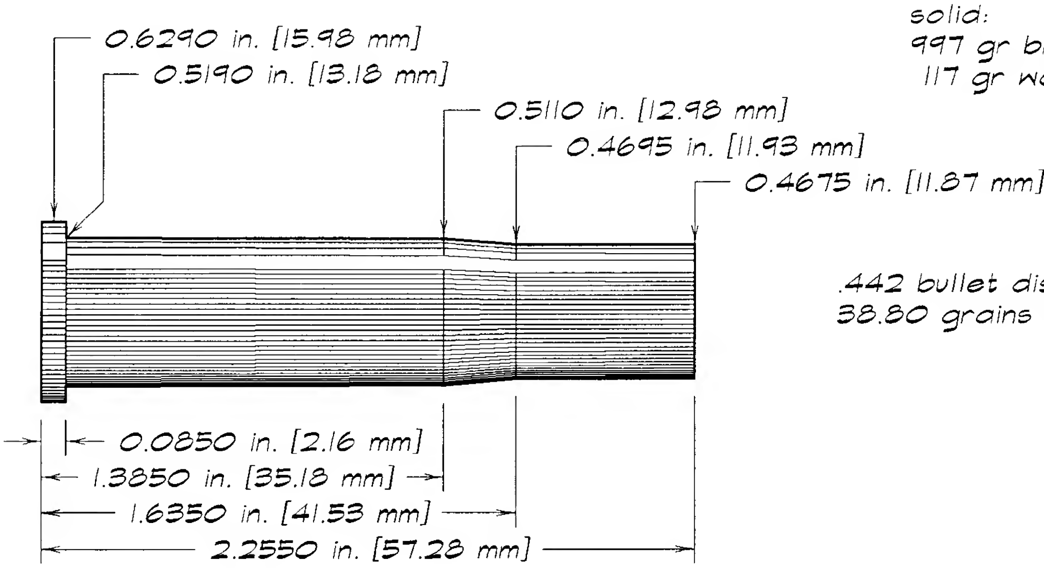
.446 bullet displaces 39.51 grains per inch.

Form from Huntington .45 Basic brass, in RCBS form and trim dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.44-90 Regular (.44-90 Remington Necked) (Winchester drawing, 1912)

solid:
997 gr brass
117 gr water

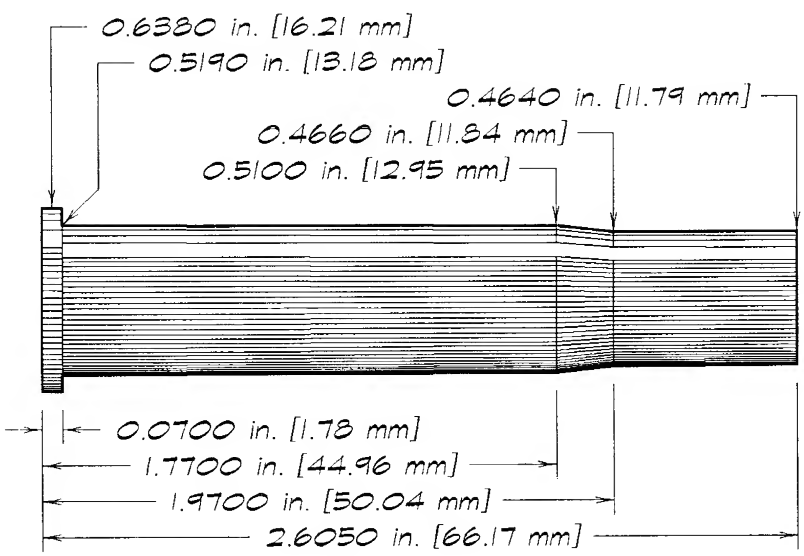


.442 bullet displaces 38.80 grains per inch.

Form from Huntington .45 Basic brass, in RCBS form and trim dies.

.44-90, .44-100, .44-105 Sharps (Winchester drawing, 1912)

solid:
1,136 gr brass
133 gr water



.446 bullet displaces 39.51 grains per inch.

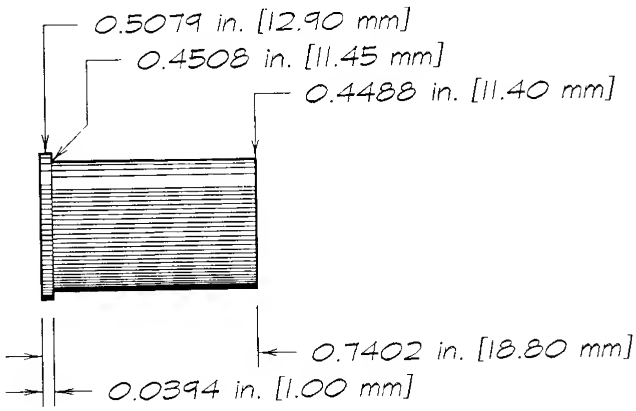
Form from Huntington .45 Basic brass, in RCBS form and trim dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.442 Webley

(Triebel maximums)

solid:
273 gr brass
32 gr water



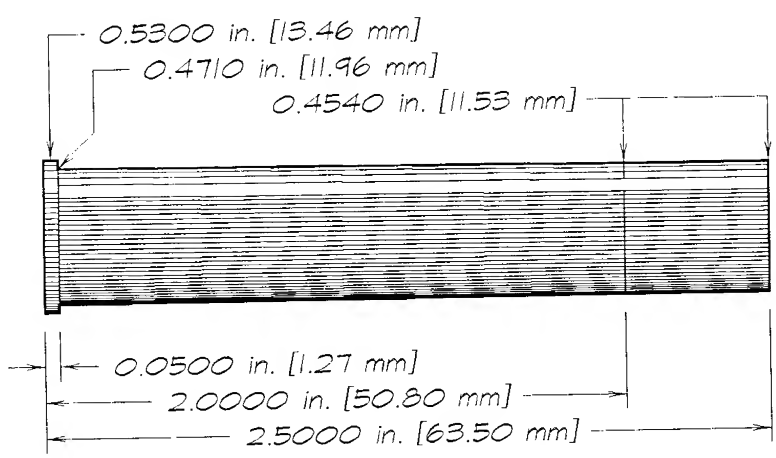
.446 bullet displaces
39.51 grains per inch.

Turn rim and base of .303 British or .30-40 Krag brass and form in RCBS form and trim dies. Ream neck, in RCBS ream die. Fire-form.

.444 Express

(designer's specs)

solid:
937 gr brass
109 gr water



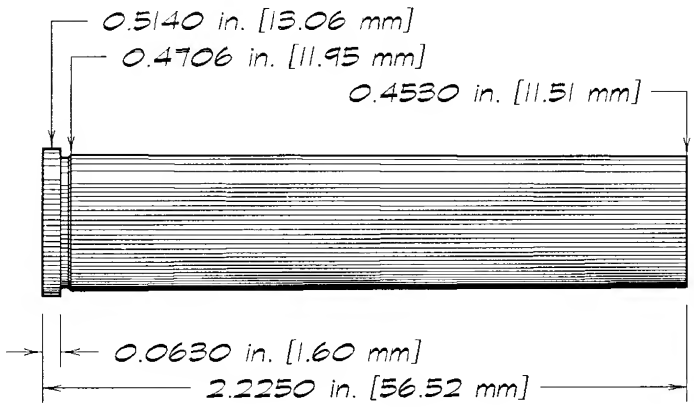
.430 bullet displaces
36.72 grains per inch.

Fire-form .400 NE Basic brass with inert filler. Trim to 2.5 inches and deburr.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.444 Marlin (SAAMI maximums)

solid:
866 gr brass
102 gr water

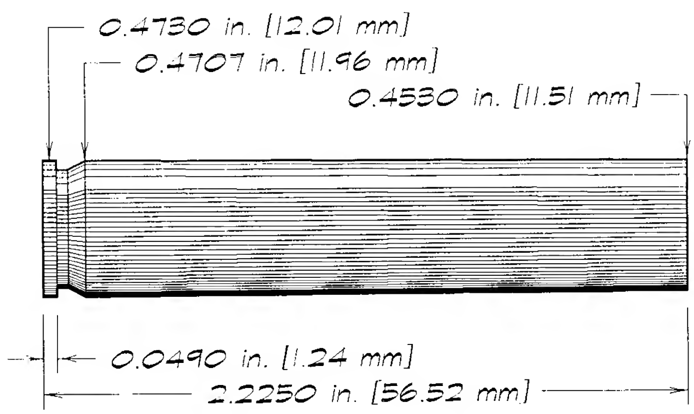


.430 bullet displaces
36.72 grains per inch.

Use .444 Marlin factory brass. Or if necessary, machine heads of 7x57mm Rimmed or 9.3x74mm Rimmed brass to .444 Marlin dimensions, trim to 2¼ inches, fire-form with inert filler, trim to 2.22 inches, ream neck in RCBS ream die, and deburr.

.444 Marlin Rimless (".425 Rimless Express") (designer's specs)

solid:
801 gr brass
94 gr water



.430 bullet displaces
36.72 grains per inch.

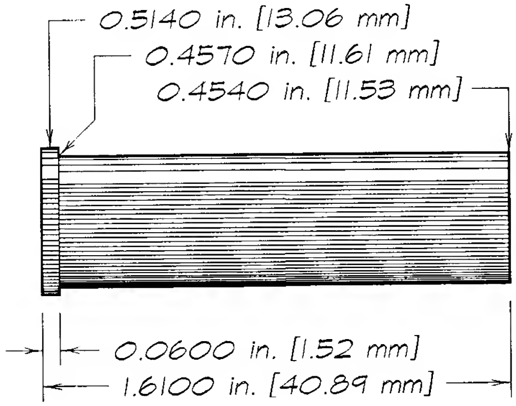
Designed by Ken Howell upon introduction of .444 Marlin, to explore potential of the .444 on a Mauser action, with heavier bullets and shorter twist. REQUIRES A SPECIAL CHAMBER (headspaces on the mouth of the case, like .30 Carbine, .45 ACP, et alii). Anneal neck and shoulder of .35 Whelen brass and fire-form with inert filler. Trim to 2½ inches and shorten gradually until bolt just closes on case.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.445 Super Magnum

(unidentified drawing)

solid:
606 gr brass
71 gr water



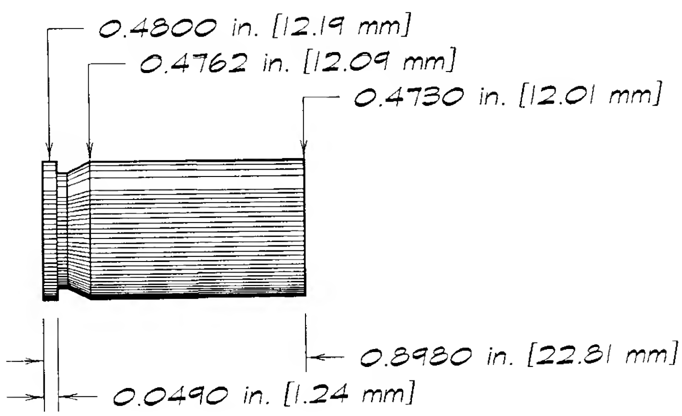
.430 bullet displaces
36.72 grains per inch.

Use IHMSA .445 Super Magnum brass. Or anneal shoulder and upper body of .30-40 Krag brass and trim to 1.7 inch. Fire-form with inert filler. Trim to 1.61 inch. Ream mouth, in RCBS ream die.

.45 Automatic (.45 ACP)

(SAAMI maximums)

solid:
334 gr brass
39 gr water



.452 bullet displaces
40.58 grains per inch.

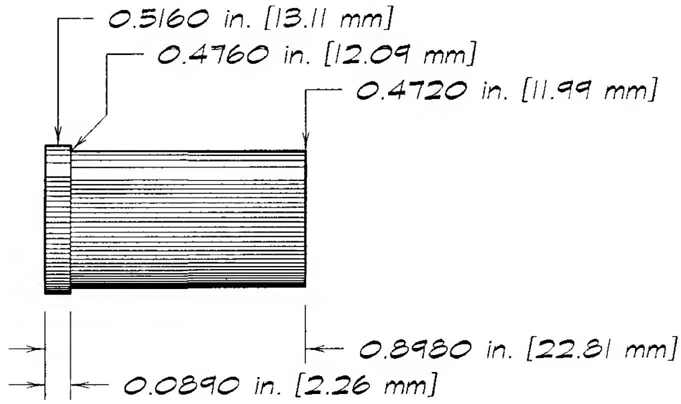
So much military and commercial factory .45 Auto brass is available, no one should ever have to shorten .45 Winchester Magnum brass to 0.898 inch and deburr the mouths. Reaming inside the necks may also be necessary.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.45 Auto Rim

(SAAMI maximums)

solid:
370 gr brass
43 gr water



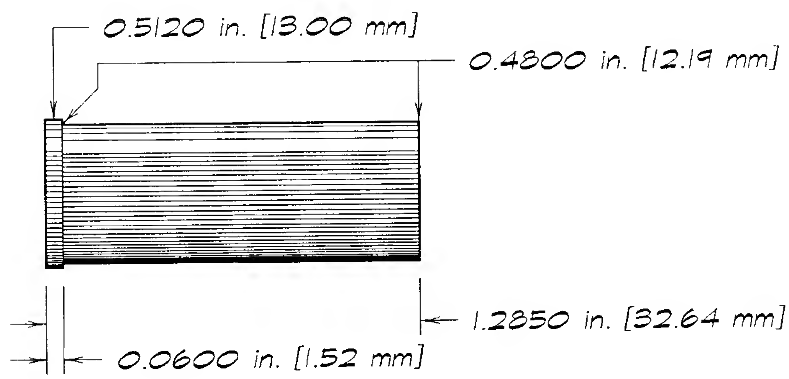
.452 bullet displaces
40.58 grains per inch.

Use factory .45 Auto Rim brass. Or use .45 Automatic (.45 ACP) brass in gun chambered to headspace on mouth of case. Or use .45 ACP brass with half-moon clips. Or shorten .45 Colt brass to 0.898 inch and deburr. If necessary, increase rim thickness in several places by peening edges.

.45 Colt (NOT ".45 Long Colt")

(SAAMI maximums)

solid:
524 gr brass
61 gr water

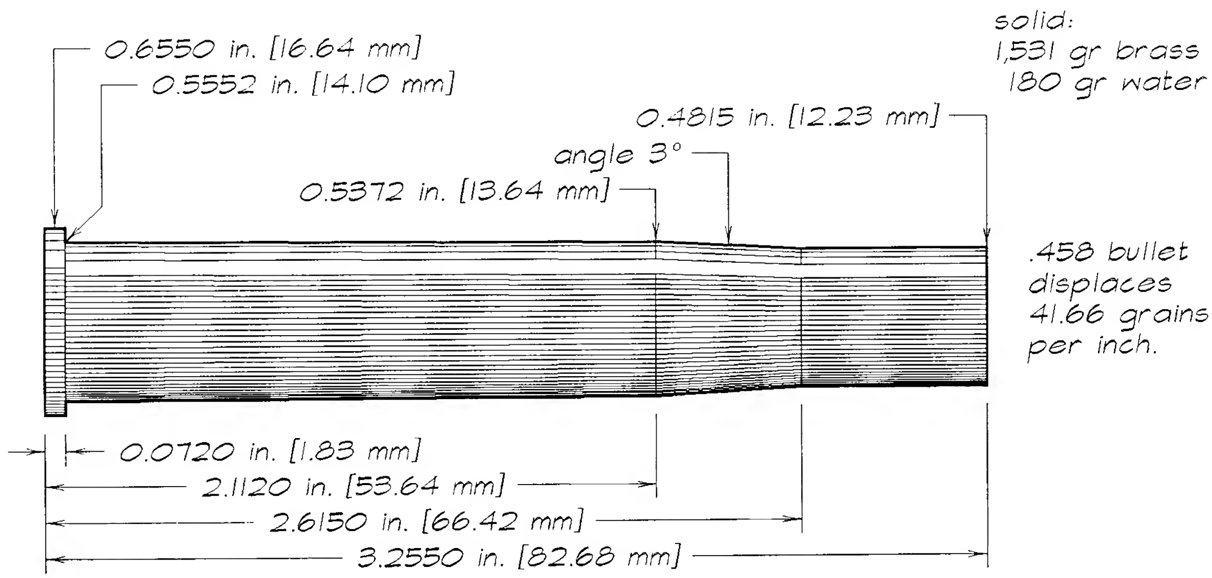


.456 bullet displaces
41.30 grains per inch.

Use factory .45 Colt brass.

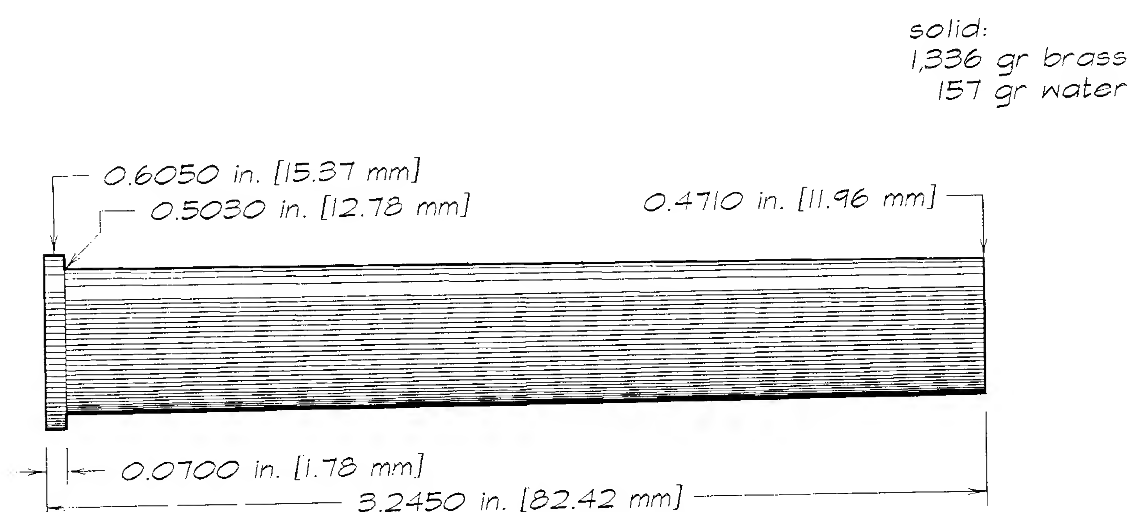
Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.45 Express 3¼-Inch (Winchester drawing, 1912)



Resize .450 Nitro Express HDS Basic brass full-length in .45 Express sizer die.

.45 HDS Basic (HDS specimen)



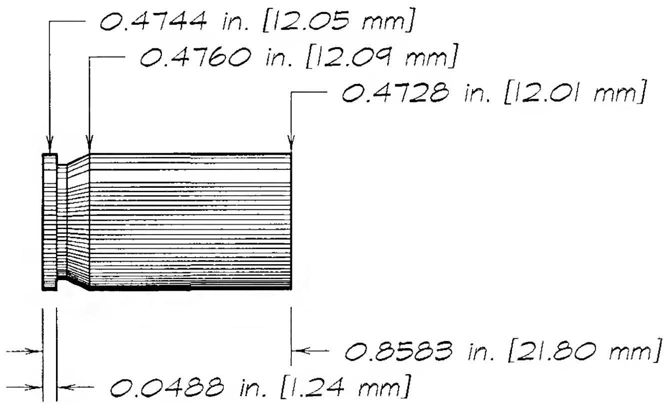
The dimensions of the rim, base, and length of this BASIC case are almost certain to be slightly different from the corresponding MAXIMUM dimensions specified for any case you plan to form from this one. Don't let the normal variation of a few ten-thousandths of an inch -- even a few thousandths -- worry you.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.45 HP

(CIP maximums)

solid:
314 gr brass
37 gr water



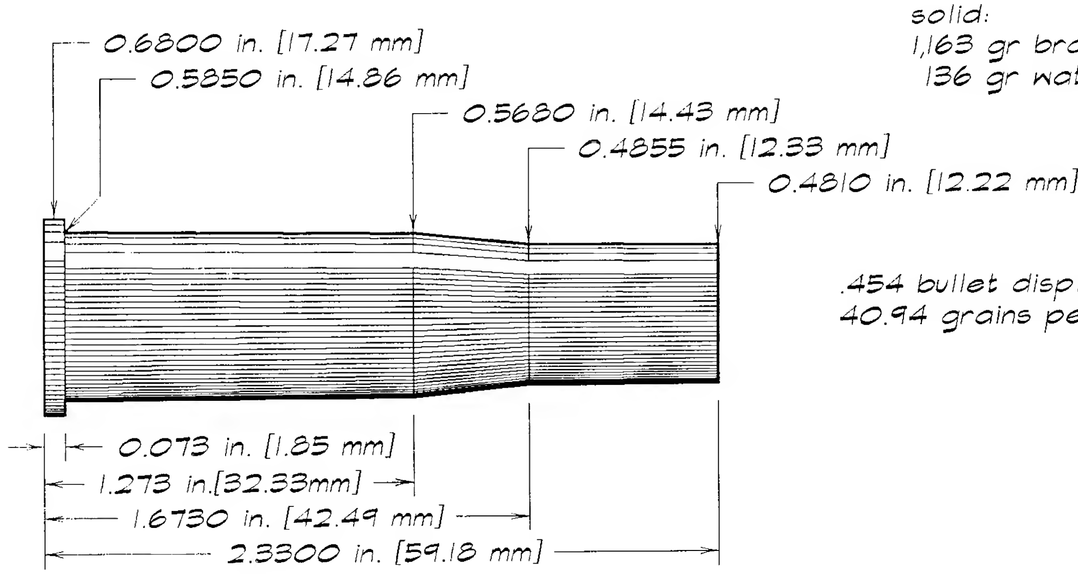
.452 bullet displaces
40.58 grains per inch.

Use factory .45 HP brass. Or trim .45 Automatic (.45 ACP) brass to 0.858 inch and deburr mouth.

.45 Peabody-Martini

(Winchester drawing, 1912)

solid:
1,163 gr brass
136 gr water



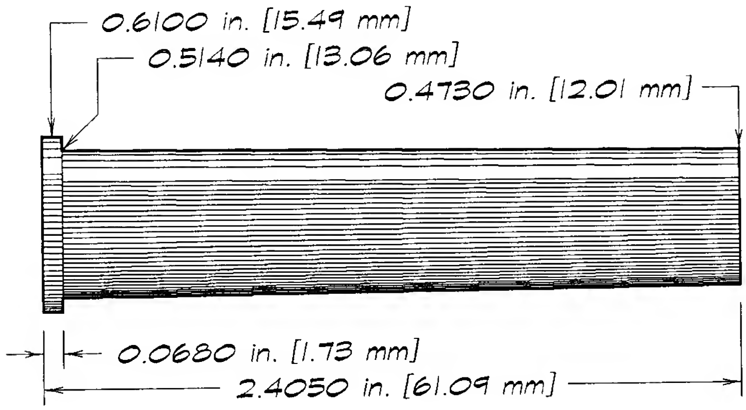
.454 bullet displaces
40.94 grains per inch.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.45 Sharps 2.4-inch

(Winchester drawing, 1912)

solid:
1,011 gr brass
119 gr water



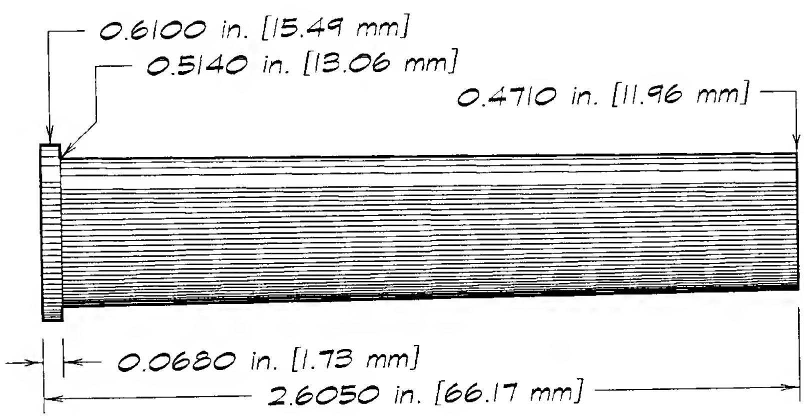
.451 bullet displaces
40.40 grains per inch.

Form from Huntington .45 Basic brass, in RCBS form die.

.45 Sharps 2.6-Inch

(Winchester drawing, 1912)

solid:
1,091 gr brass
128 gr water



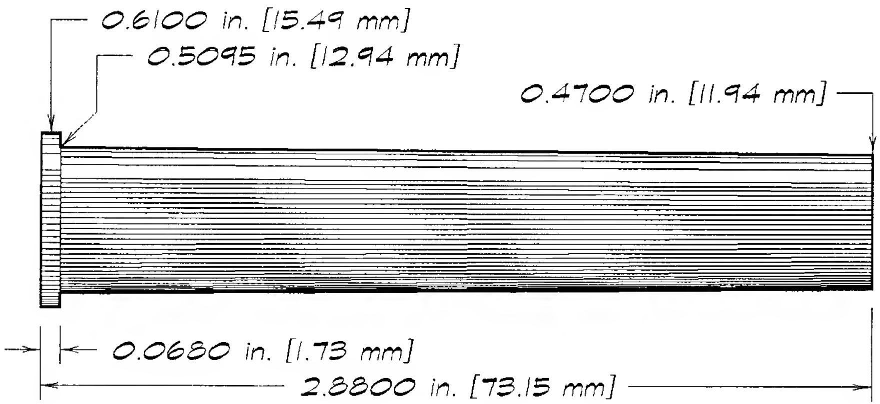
.451 bullet displaces
40.40 grains per inch.

Form from Huntington .45 Basic brass, in RCBS form die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.45 Sharps 2⅞-inch (Winchester drawing, 1912)

solid:
1,199 gr brass
141 gr water

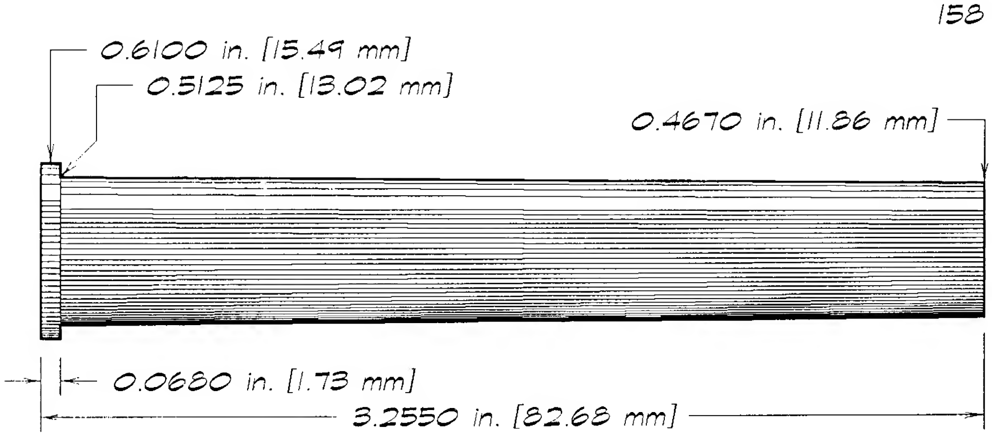


.451 bullet displaces 40.40 grains/inch.

Form from Huntington .45 Basic brass, in RCBS form die.

.45 Sharps 3¼-Inch (.45-120-550) (Winchester drawing, 1912)

solid:
1,350 gr brass
158 gr water



.451 bullet displaces 40.40 grains/inch.

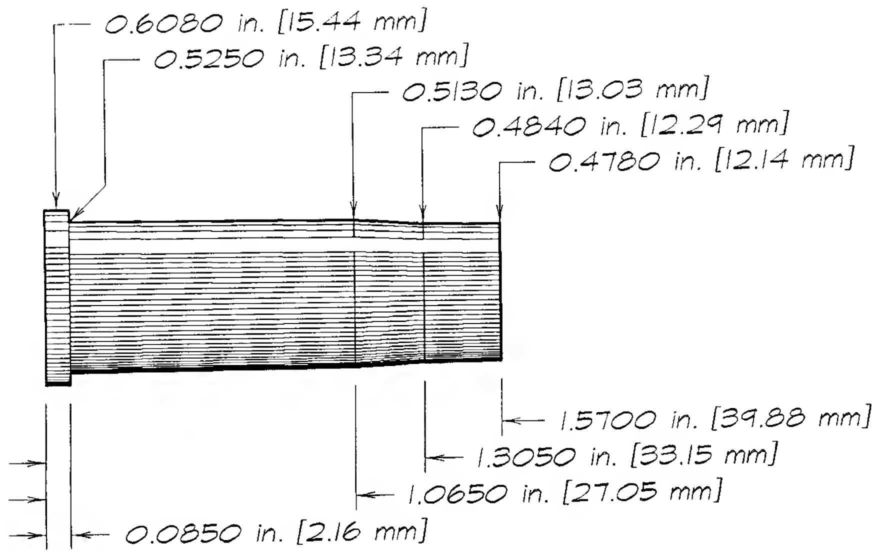
Form from Huntington .45 Basic brass, in RCBS form die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.45 Sporting (Peabody)

(Winchester drawing, 1912)

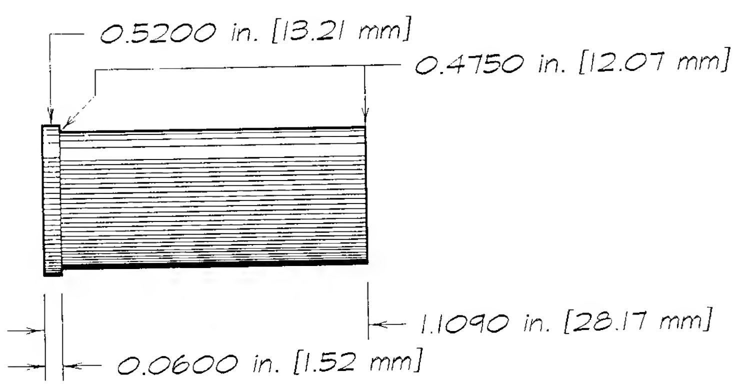
solid:
699 gr brass
82 gr water



.45 S&W Schofield

(David J LeGate)

solid:
457 gr brass
54 gr water



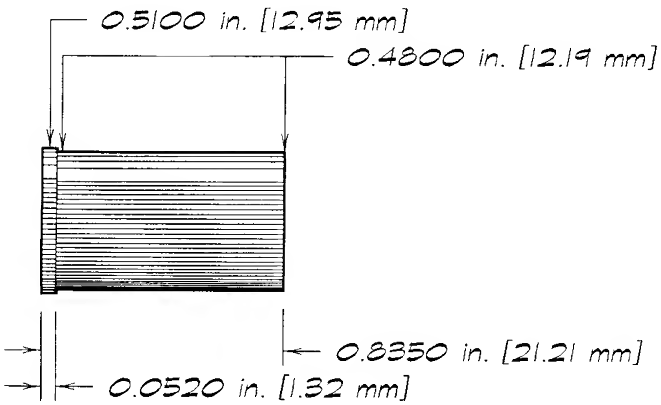
.451 bullet displaces
40.40 grains per inch.

Trim .45 Colt brass to 1.11 inch and deburr.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.45 Webley (Winchester drawing, 1912)

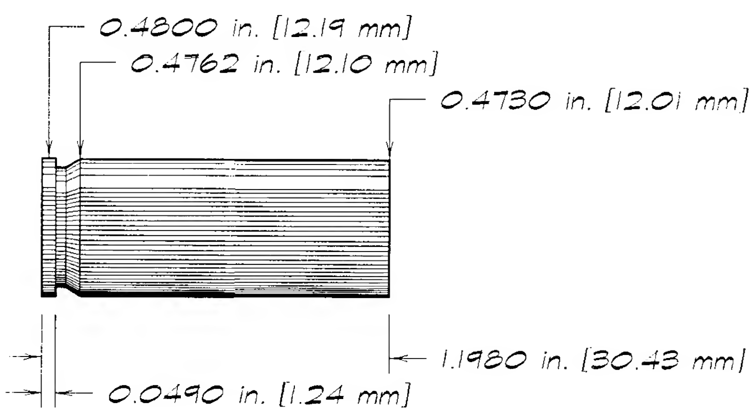
solid:
338 gr brass
40 gr water



Shorten .45 Colt to 0.835 inch long. SAAMI's maximum dimensions show the .45 Colt rim as a hair thicker and a smidge bigger in diameter, but try some first. They may be just right, without thinning or turning. Chamfer mouth.

.45 Winchester Magnum (SAAMI maximums)

solid:
452 gr brass
53 gr water



.452 bullet displaces
40.58 grains per inch.

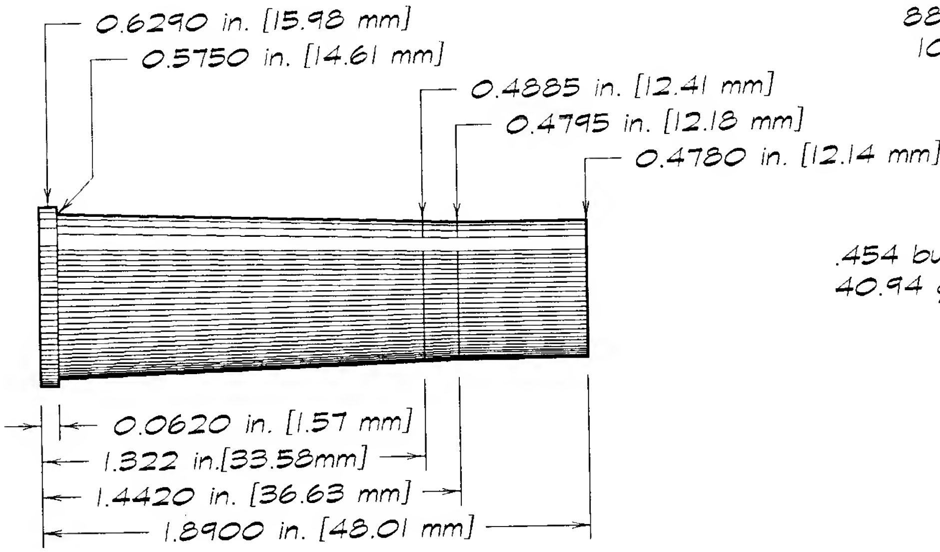
Use factory .45 Winchester Magnum brass. Or form from .308 Winchester, .270 Winchester, .280 Remington, .30-06, .35 Whelen, .25-06, 7x57mm, 8x57mm, 9x57mm, or any other case based on the .30-06 Springfield, in RCBS form and trim dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.45-60 Winchester

(Winchester drawing, 1912)

solid:
889 gr brass
104 gr water



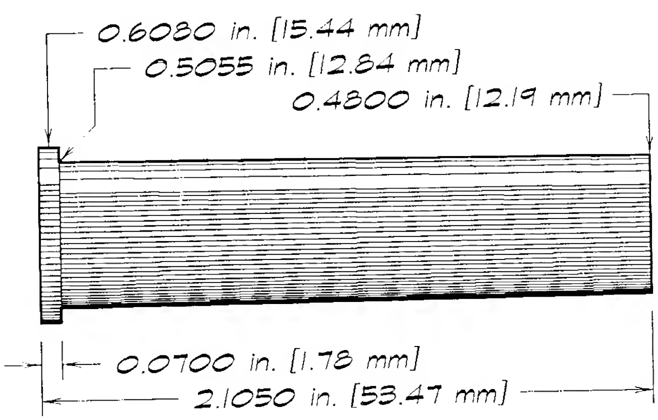
.454 bullet displaces
40.94 grains per inch.

Form from .45-70 Springfield, in RCBS form and trim dies.

.45-70 Government (.45-70 Springfield)

(SAAMI maximums)

solid:
890 gr brass
104 gr water



.458 bullet displaces
41.66 grains per inch.

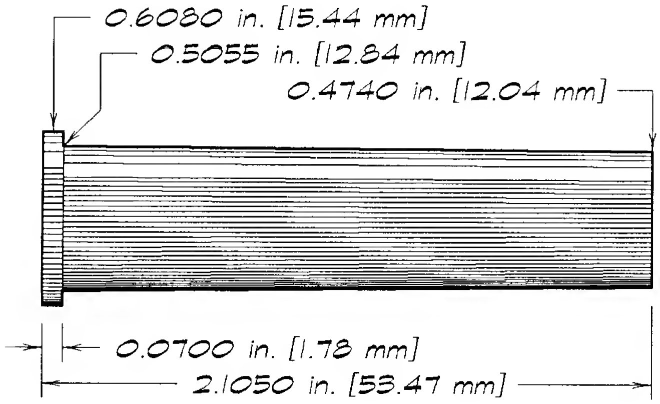
Use recently manufactured .45-70 brass, or form from Huntington .45 Basic in RCBS form die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.45-70 Sharps

(Winchester drawing, 1912)

solid:
881 gr brass
103 gr water



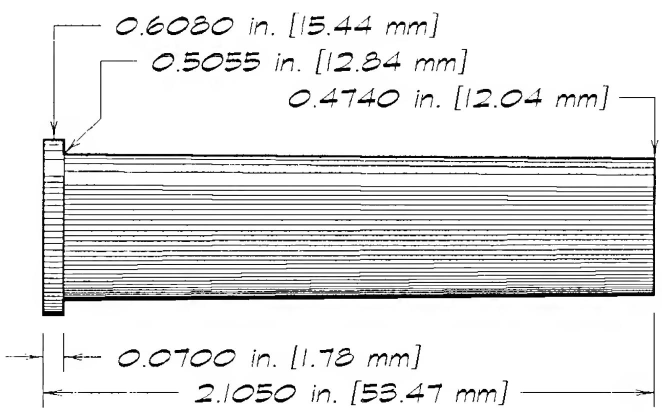
.457 bullet displaces
41.48 grains per inch.

This is simply the .45-70 Government case under a different name, so use .45-70 Government brass without modification. Or form from Huntington .45 Basic brass, in RCBS form die.

.45-75 Sharps

(Winchester drawing, 1912)

solid:
881 gr brass
103 gr water



.458 bullet displaces
41.66 grains per inch.

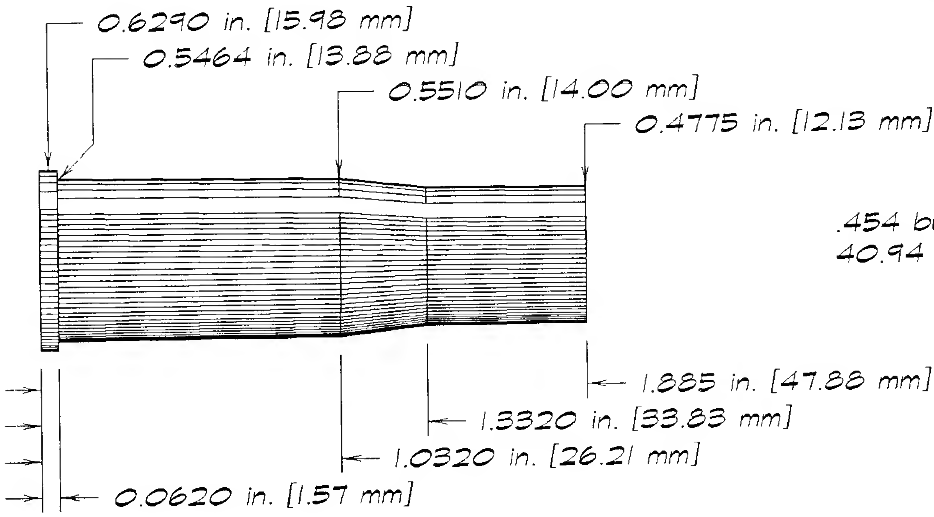
Use .45-70 Springfield brass, in .45-70 Springfield dies, since that's what this "Sharps" cartridge is: the .45-70 with an alias.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.45-75 Winchester

(Winchester drawing, 1912)

solid:
949 gr brass
111 gr water



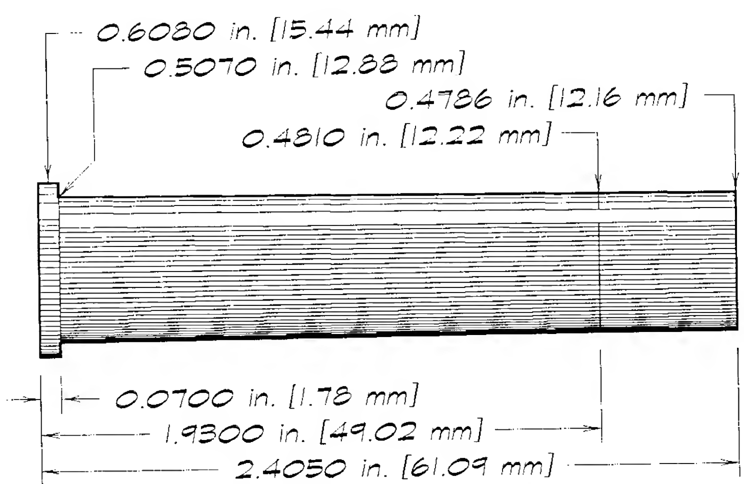
.454 bullet displaces
40.94 grains per inch.

Form from .348 Winchester, .50 Sharps 3¼-inch Basic, or .50-110 original brass, in respective RCBS form, trim, and ream dies.

.45-82 Winchester

(Winchester drawing, 1912)

solid:
1,014 gr brass
119 gr water



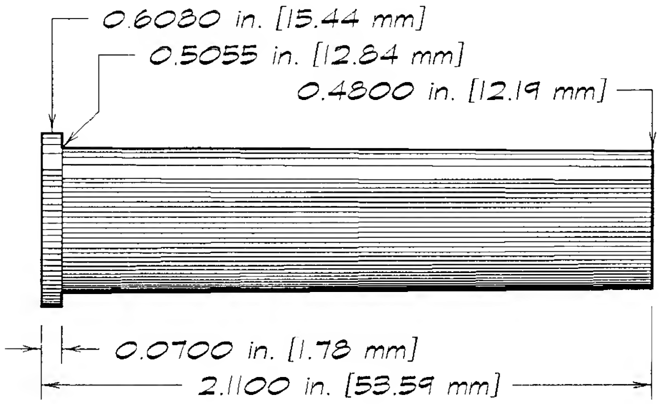
.457 bullet displaces
41.48 grains per inch.

Form from Huntington .45 Basic brass, in RCBS form dies. Winchester's drawings for these three cartridges (.45-82 15 March 1912, .45-85 22 March 1912, .45-90 16 February 1912) show every case dimension identical for all three cartridges. So as far as case dimensions are concerned, the .45-82 is the .45-85 is the .45-90 Winchester. One set of dies, then, forms and loads "all three."

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.45-85 Bullard (Winchester drawing, 1912)

solid:
893 gr brass
105 gr water

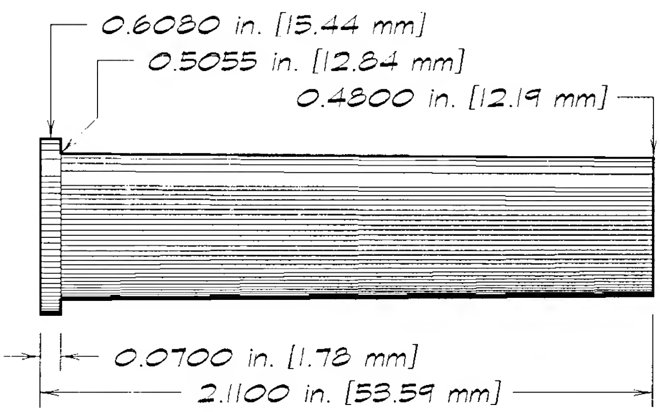


.458 bullet displaces 41.66 grains per inch.

Use .45-70 Government brass. Or form HDS .45 Basic brass in RCBS form dies.

.45-85 Marlin (Winchester drawing, 1912)

solid:
893 gr brass
105 gr water



.458 bullet displaces 41.66 grains per inch.

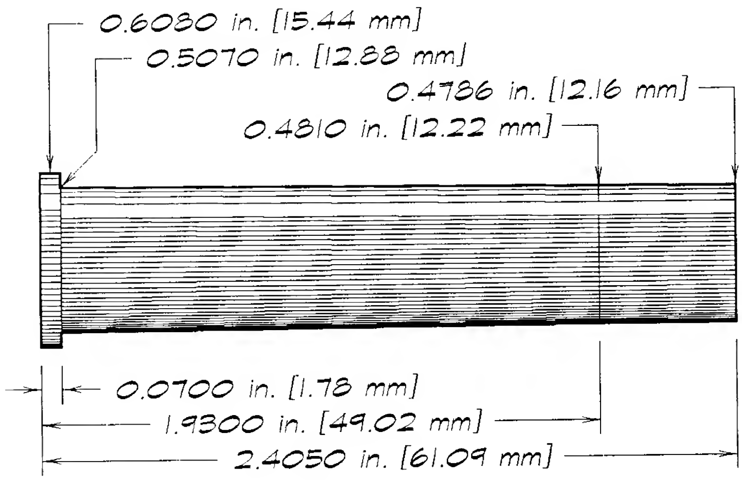
Use .45-70 Government brass. Or form from HDS Basic brass, in RCBS form-and-trim die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.45-85 Winchester

(Winchester drawing, 1912)

solid:
1,014 gr brass
119 gr water



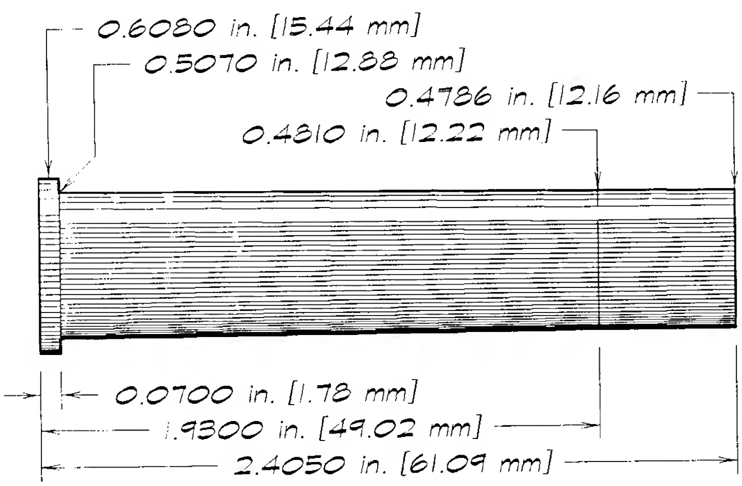
.457 bullet displaces
41.48 grains per inch.

Form from Huntington .45 Basic brass, in RCBS form die. Winchester's drawings for these three cartridges (.45-82 15 March 1912, .45-85 22 March 1912, .45-90 16 February 1912) show every case dimension identical for all three cartridges. So as far as case dimensions are concerned, the .45-82 is the .45-85 is the .45-90 Winchester. One set of dies, then, forms and loads "all three."

.45-90 Winchester

(Winchester drawing, 1912)

solid:
1,014 gr brass
119 gr water

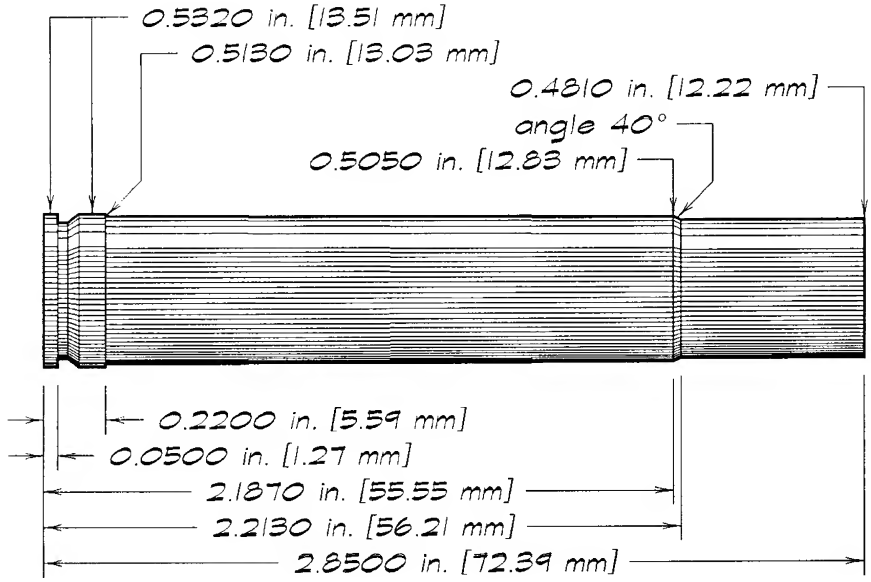


.457 bullet displaces
41.48 grains per inch.

Use recently manufactured .45-90 brass, or form from HDS .45 Basic brass, in RCBS form die. Winchester's 1912 drawings for these three cartridges show every case dimension identical for all three cartridges. (See note above.)

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.450 Ackley Magnum (David J LeGate)

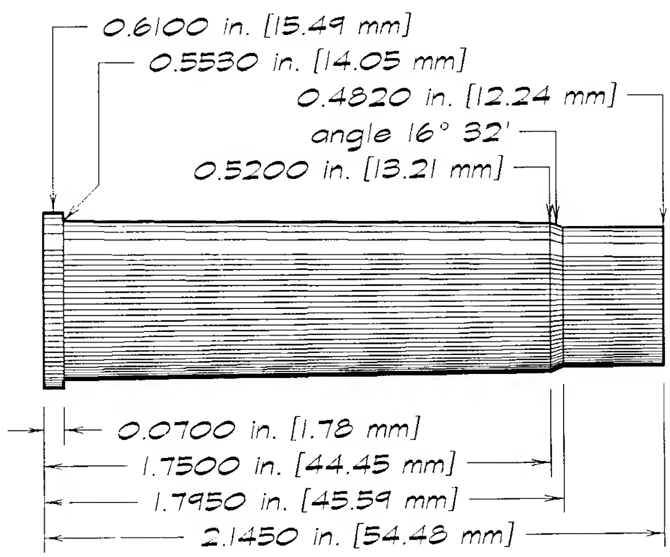


solid:
1,260 gr brass
148 gr water

.458 bullet displaces 41.67 grains per inch.

Anneal neck and shoulder of .375 H&H Magnum brass. Fire-form with inert filler.

.450 Alaskan (David J LeGate)



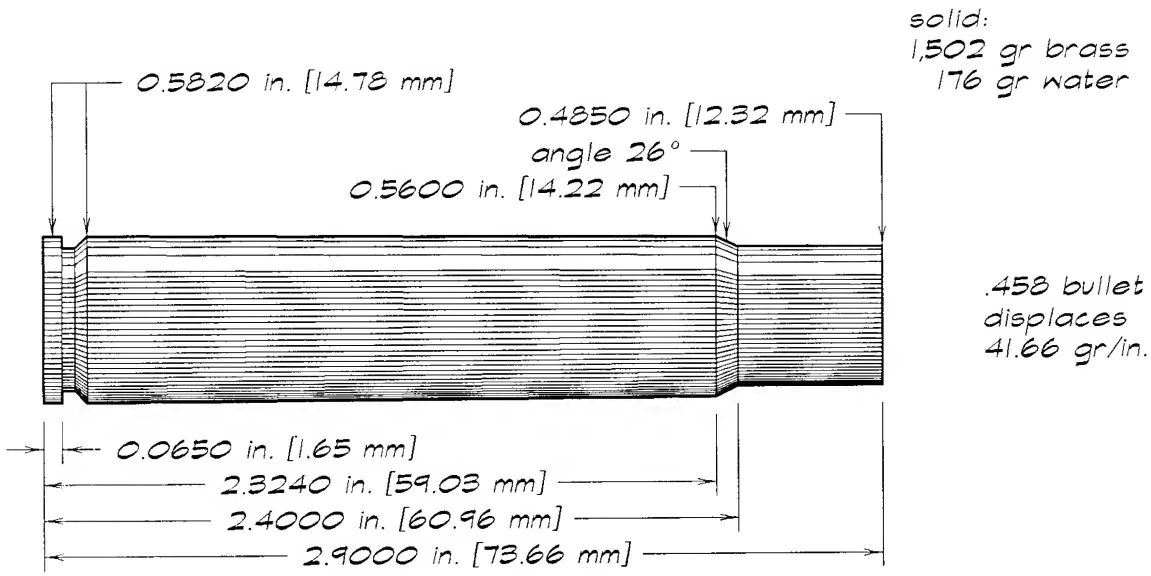
solid:
1,069 gr brass
125 gr water

.458 bullet displaces 41.66 grains per inch.

Anneal neck and shoulder of .348 Winchester brass. Fire-form with inert filler.

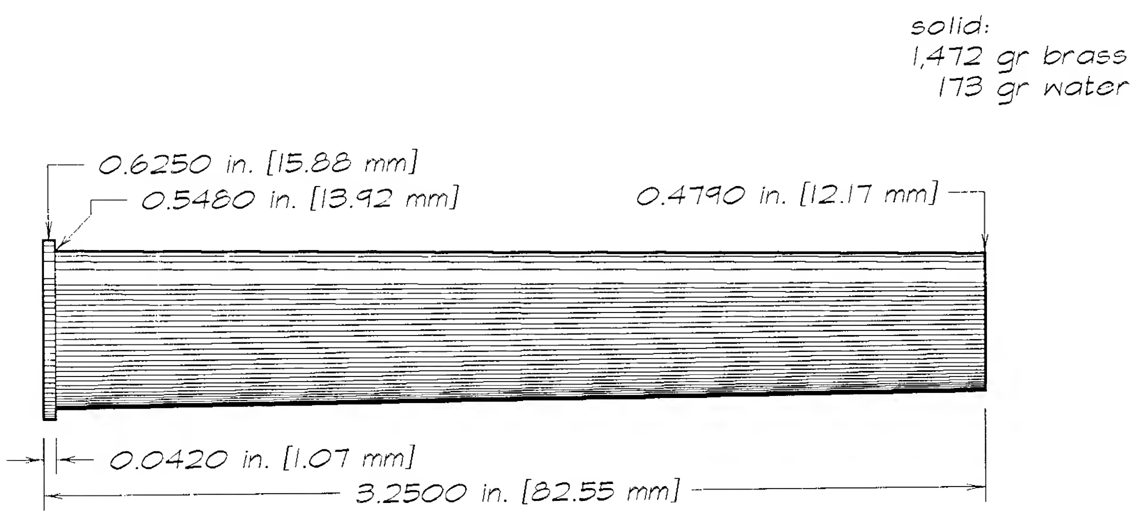
Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.450 Dakota (Dakota Arms drawing)



Resize .416 Rigby brass full-length in body of .450 Dakota sizer die (with decapping assembly removed) and fire-form with inert filler.

.450 Express (Kynoch drawing, 1884)

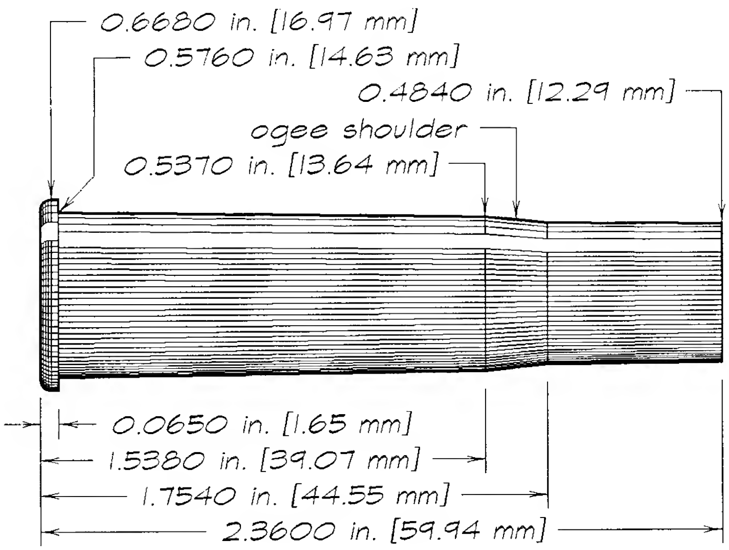


Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.450 Gatling

(Kynoch drawing, 1884)

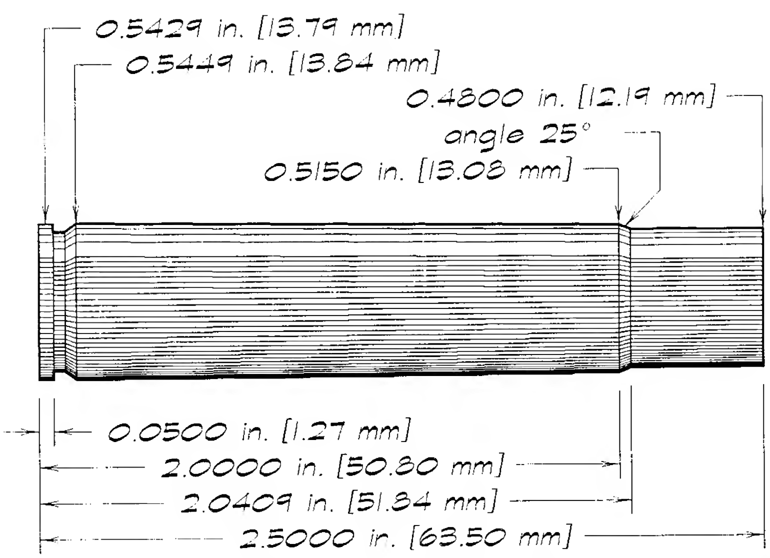
solid:
1,156 gr brass
136 gr water



.450 Howell

(designer's specs)

solid:
1,165 gr brass
137 gr water



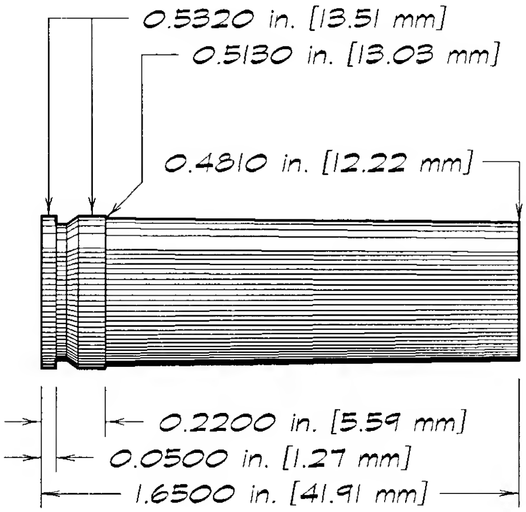
.458 bullet displaces 41.66 grains per inch.

Anneal neck and shoulder of .404 Jeffery brass. Form in RCBS .450 Howell form-and-trim die. Ream inside neck with RCBS neck-ream set. Trim to 2½ inches and deburr. Fire-form with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.450 Jurras (Jurras drawing)

solid:
726 gr brass
85 gr water

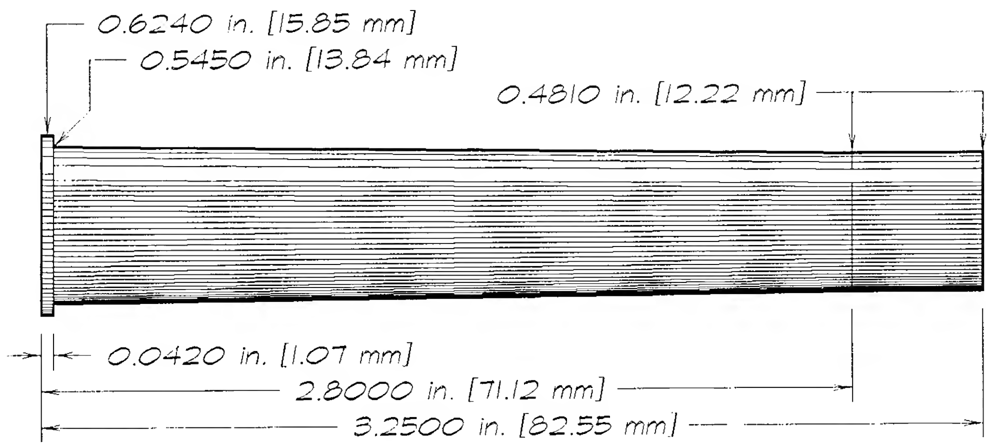


.458 bullet displaces 41.66 grains per inch.

Anneal upper body of .458 Winchester brass. Trim to 1.65 inch and deburr.

.450 Nitro Express (ICI Metals Ltd dwg)

solid:
1,448 gr brass
170 gr water



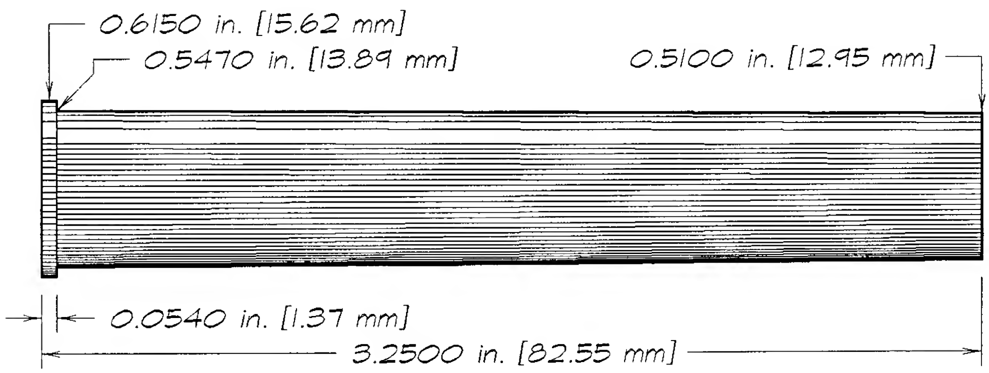
.458 bullet displaces 41.66 grains per inch.

Use .450 NE 3¼-Inch brass. Or form from .450 NE Basic brass, in RCBS form die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.450 Nitro Express HDS Basic (HDS specimen)

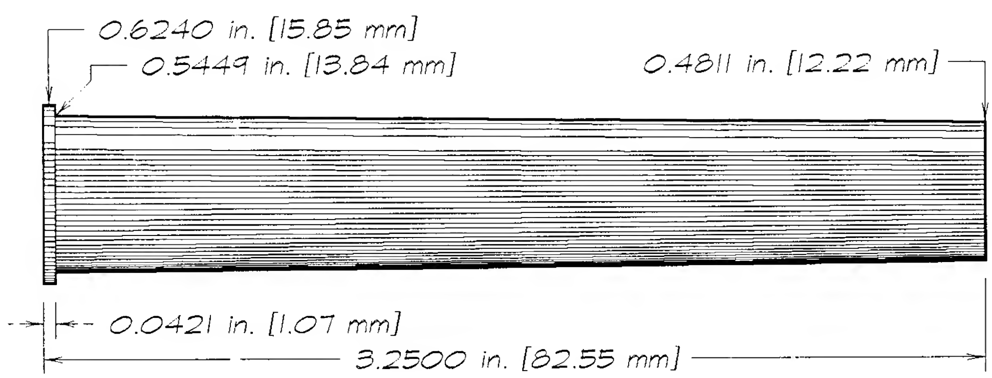
solid:
1,565 gr brass
184 gr water



The dimensions of the rim, base, and length of this BASIC case are almost certain to be slightly different from the corresponding MAXIMUM dimensions specified for any case you plan to form from this one. Don't let the normal variation of a few ten-thousandths of an inch -- even a few thousandths -- worry you.

.450 Nitro Express 3¼-Inch (CIP maximums)

solid:
1,467 gr brass
172 gr water



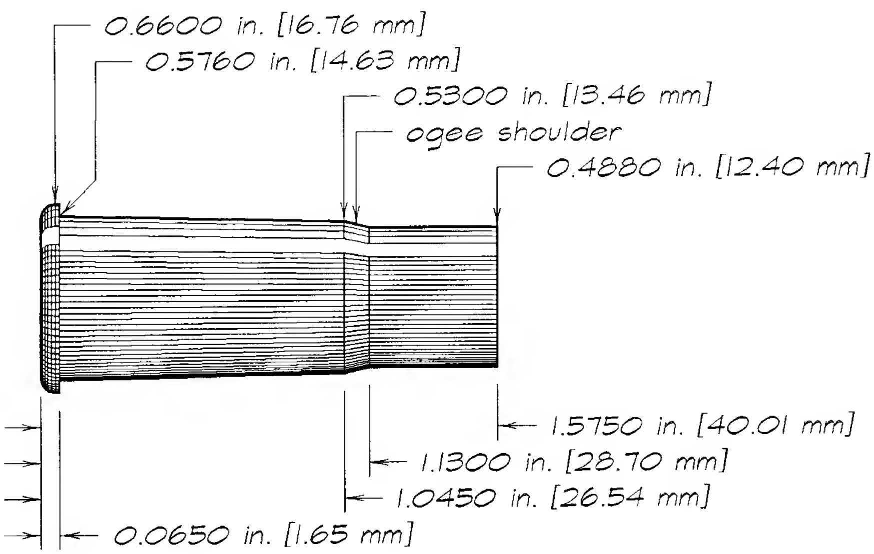
.458 bullet displaces 41.66 grains per inch.

Use factory .450 NE 3¼-Inch brass. Or form from .450 NE Basic brass, in RCBS form die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

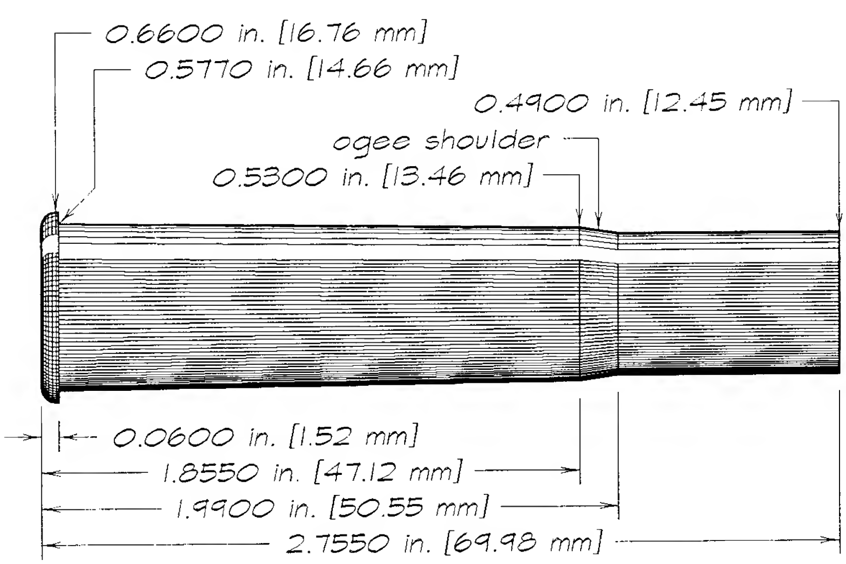
.450 No. 1 Westley Richards Carbine (Kynoch drawing, 1884)

solid:
773 gr brass
91 gr water



.450 No. 1 Westley Richards Express (Kynoch drawing, 1884)

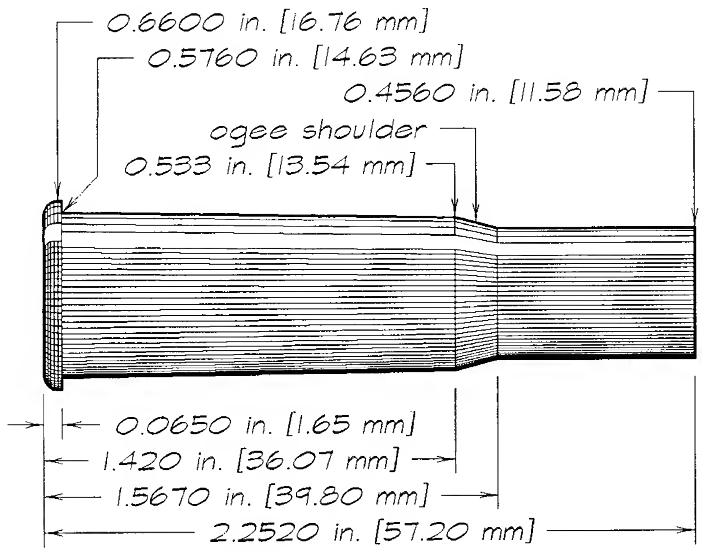
solid:
1,359 gr brass
159 gr water



Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

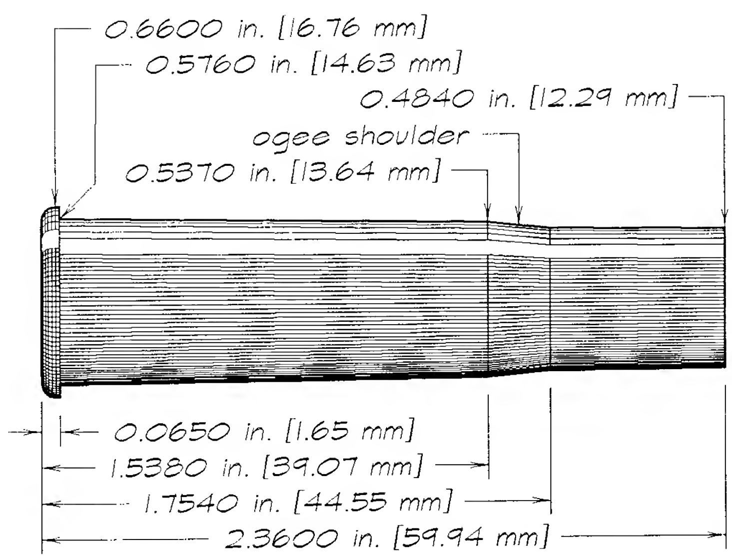
.450 No. 1 Westley Richards Musket (Kynoch drawing, 1884)

solid:
1,042 gr brass
122 gr water



.450 No. 2 Westley Richards Musket (Kynoch drawing, 1884)

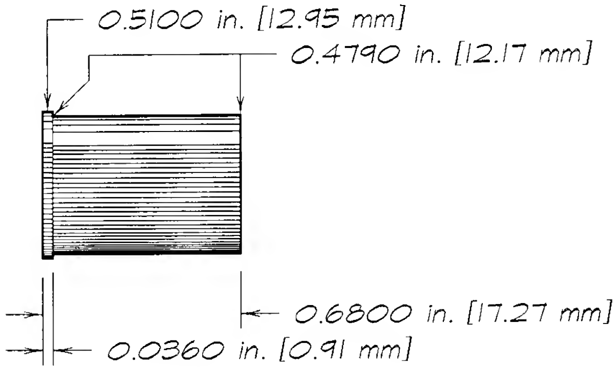
solid:
1,163 gr brass
136 gr water



Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.450 Revolver (ICI Metals Ltd dwg)

solid:
275 gr brass
32 gr water

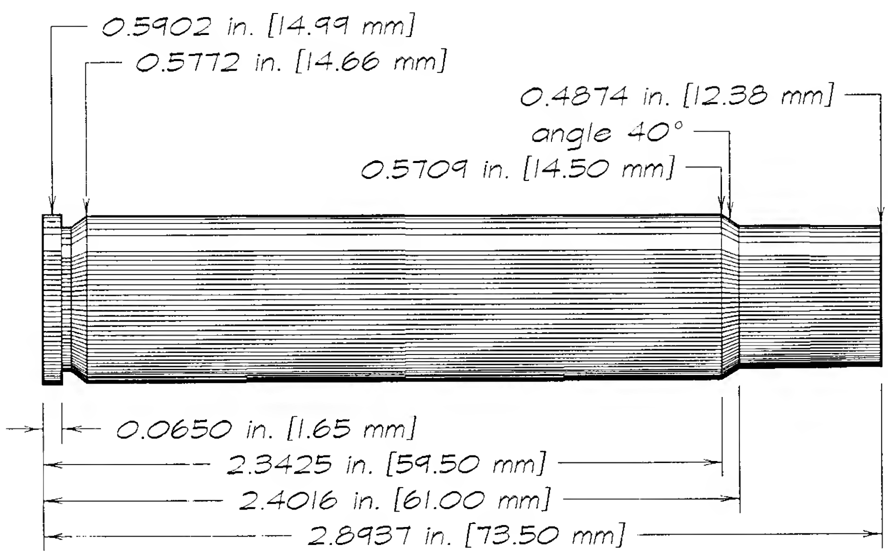


.456 bullet displaces 41.30 grains per inch.

Anneal upper half of Remington .45 Colt brass, trim to 0.68 inch, and deburr. Ream mouth and thin rim (from FRONT only) if necessary.

.450 Rigby Rimless (CIP maximums)

solid:
1,523 gr brass
179 gr water



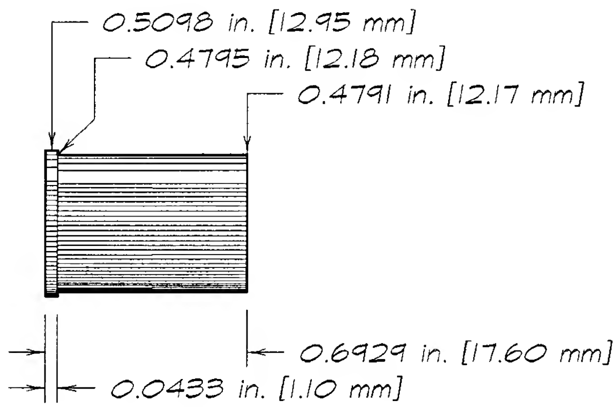
.458 bullet displaces 41.66 grains per inch.

Use factory .450 Rigby brass. Or form .416 Rigby brass in RCBS form die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.450 Short (CIP maximums)

solid:
280 gr brass
33 gr water

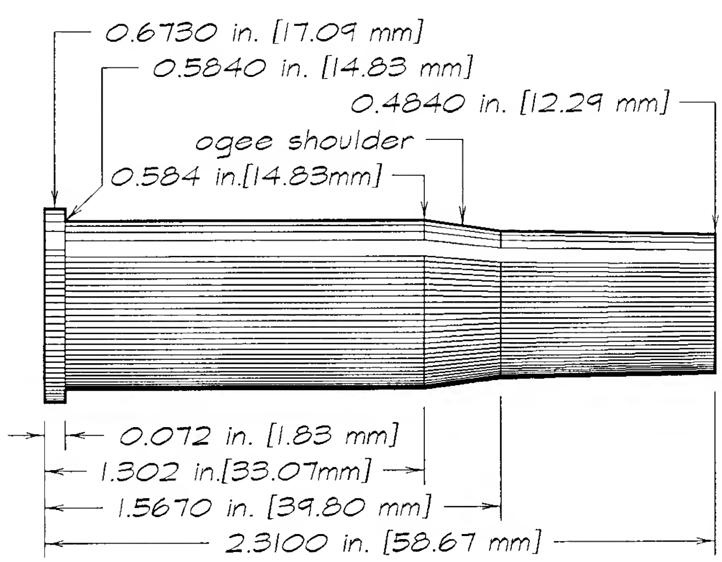


.456 bullet displaces
41.30 grains per inch.

Use factory .450 Short brass. Or, if desperate, trim .45 Colt or .45 Auto Rim brass to 0.69 inch long, deburr, and turn rims to .450 Short dimensions.

.450 Peabody-Martini (Turkish gov't pattern) (Kynoch drawing, 1884)

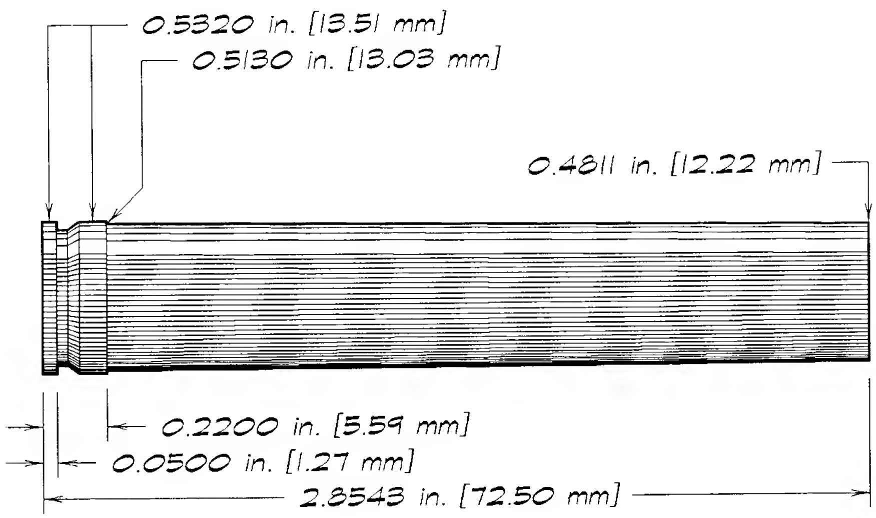
solid:
1,260 gr brass
148 gr water



Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.450 Watts Magnum (Triebel maximums)

solid:
1,254 gr brass
147 gr water

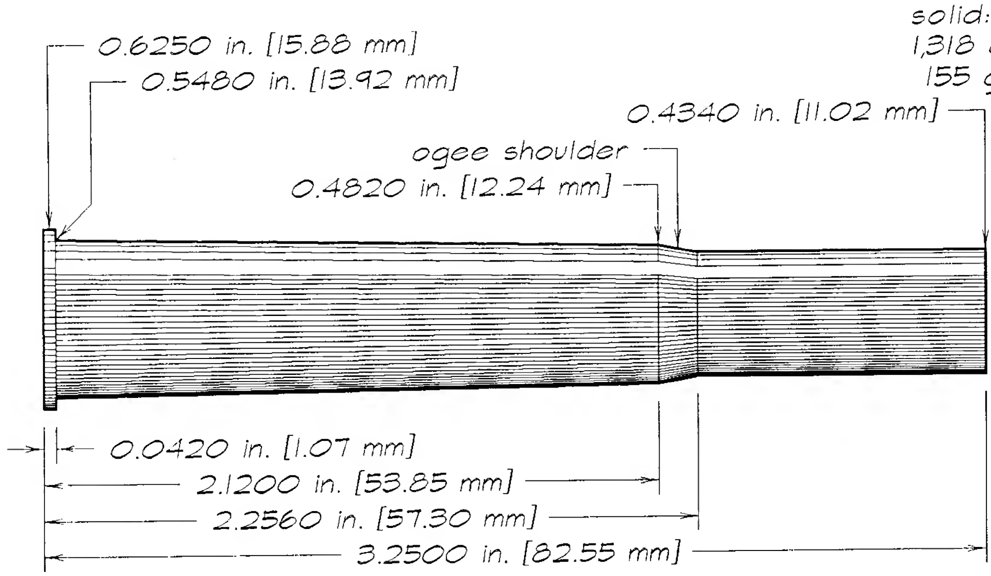


.458 bullet displaces 41.66 grains per inch.

Use H&H cylindrical brass. Or anneal neck, shoulder, and upper body of .375 H&H Magnum brass and fire-form with inert filler.

.450-.400 Express (Kynoch drawing, 1884)

solid:
1,318 gr brass
155 gr water

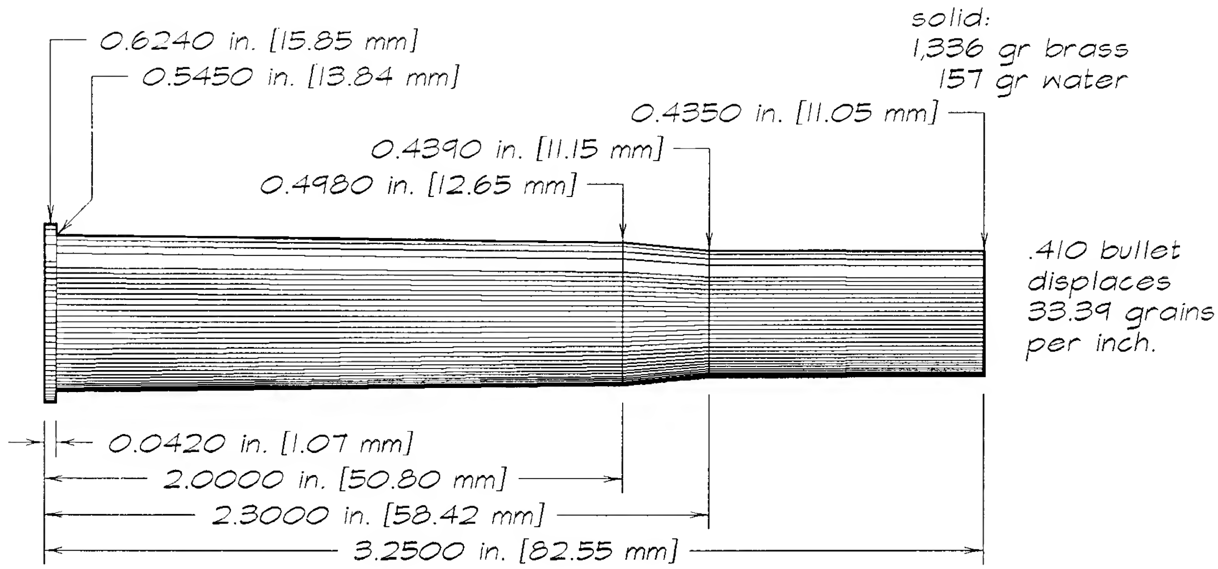


.410 bullet displaces 33.39 grains per inch.

Form from .450 NE 3¼-Inch or .450 NE Basic brass, in respective set of RCBS form and trim dies.

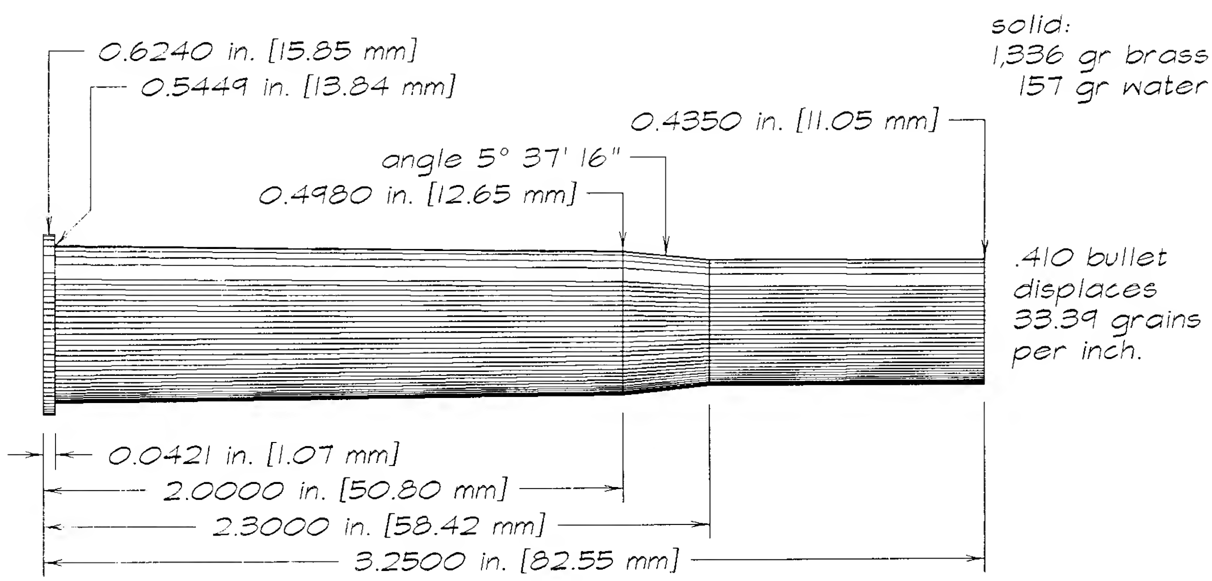
Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.450-.400 Magnum Nitro Express 3¼-Inch (Birmingham Proof House)



Use factory .450-.400 NE 3¼-Inch brass. Or form from .450 NE Basic brass, in RCBS form dies.

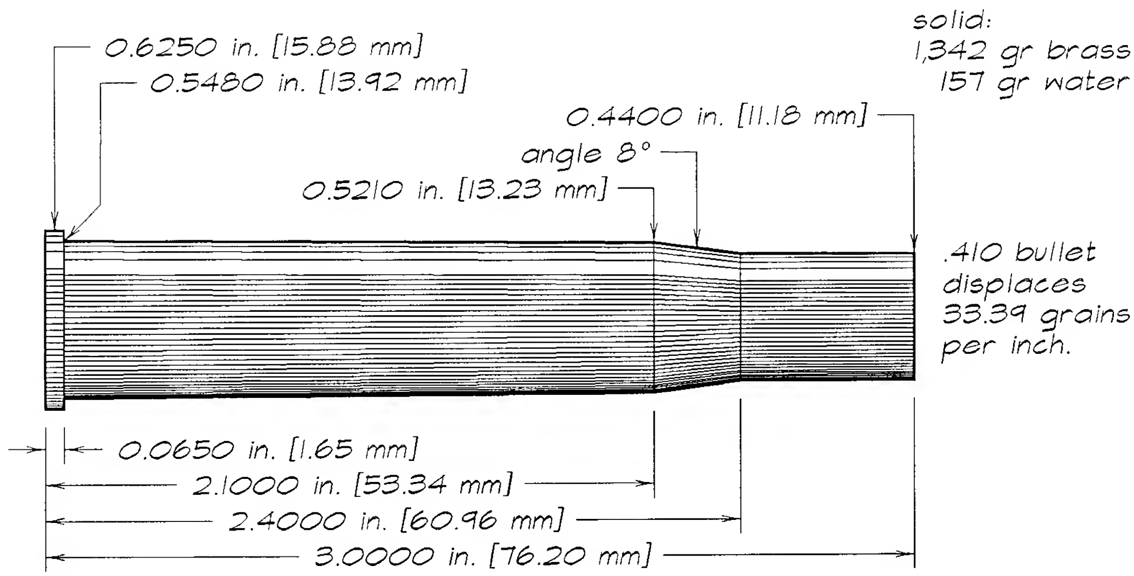
.450-.400 Magnum Nitro Express 3¼-Inch (CIP maximums)



Use factory .450-.400 Magnum NE 3¼-Inch brass. Or form from .450 Nitro Express Basic brass, in RCBS form, trim, and neck-ream dies.

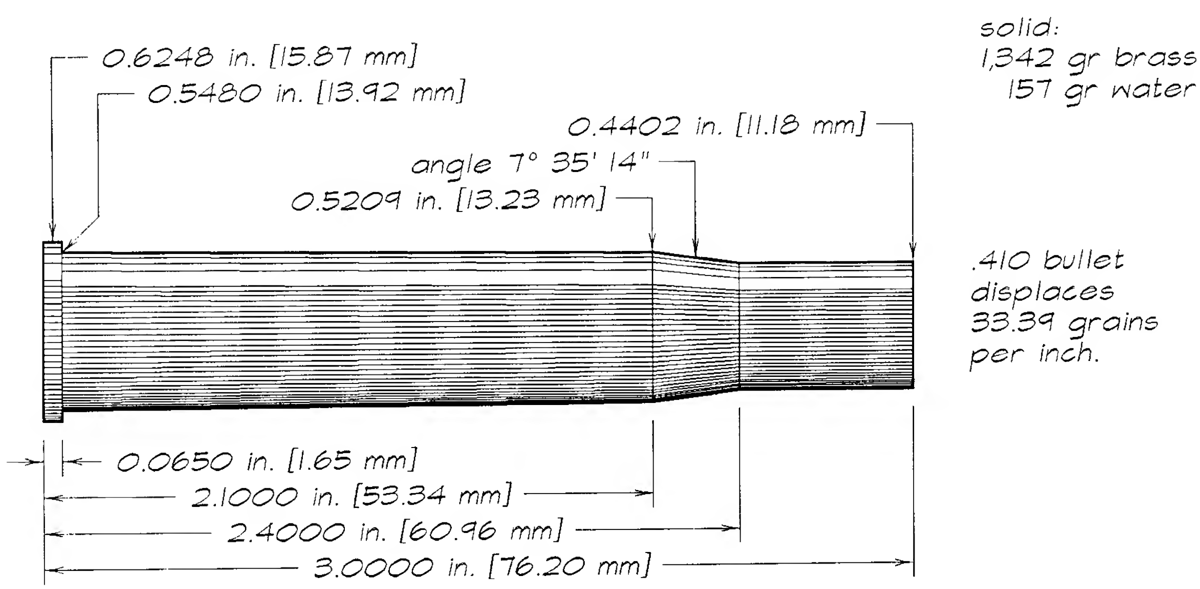
Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.450-.400 Nitro Express 3-Inch (Birmingham Proof House)



Use factory .450-.400 NE 3-Inch brass. Or form from .450 Nitro Express brass or Nitro Express Basic brass, in respective set of RCBS form and trim dies.

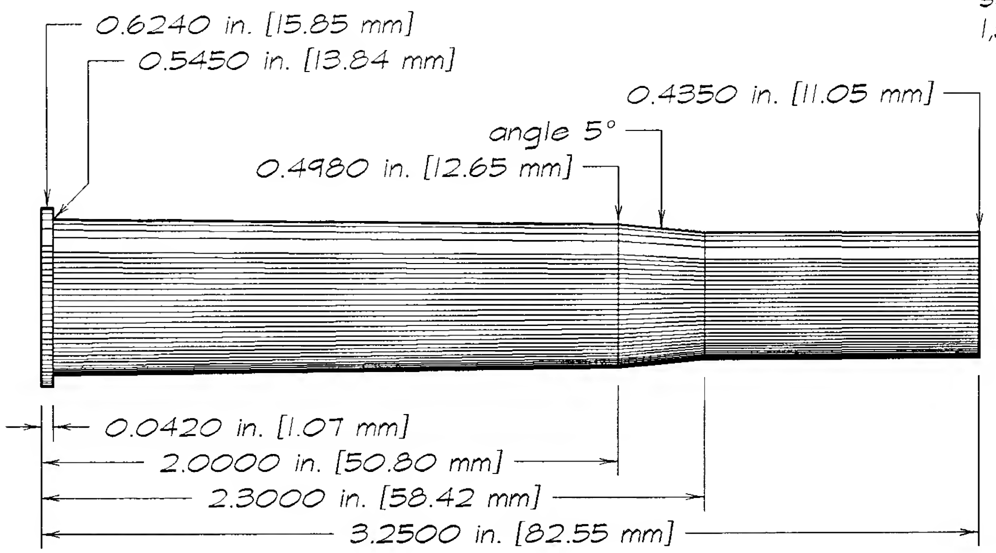
.450-.400 Nitro Express 3-Inch (CIP maximums)



Use factory .450-.400 NE 3-Inch brass. Or form from .450 Nitro Express brass or Nitro Express Basic brass, in respective RCBS form and trim dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.450-.400 3¼-Inch Nitro Express (ICI Metals Ltd dwg)

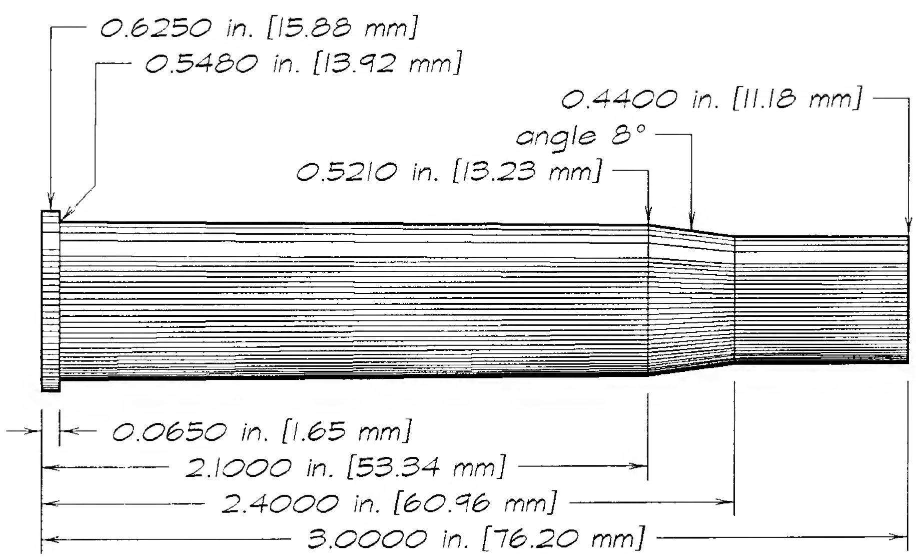


solid:
1,336 gr brass
157 gr water

.410 bullet displaces 33.39 grains per inch.

Use .450-.400 3¼ NE brass. Or form from .450 NE Basic brass, in RCBS form and trim dies.

.450-.400 3-Inch Express (Jeffery and Westley Richards) (ICI Metals Ltd dwg)



solid:
1,342 gr brass
157 gr water

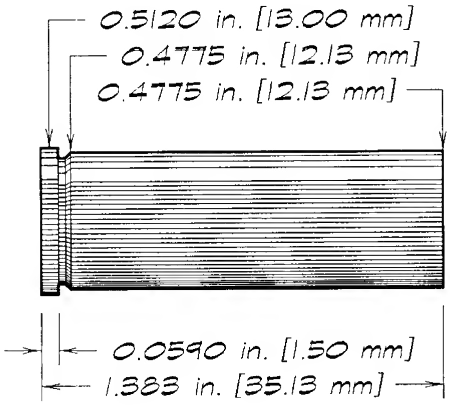
.410 bullet displaces 33.39 grains per inch.

Form .450-.400 3-Inch Basic or .450 Basic brass, in respective RCBS form and trim dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.454 Casull (Freedom Arms drawing)

solid:
517 gr brass
61 gr water

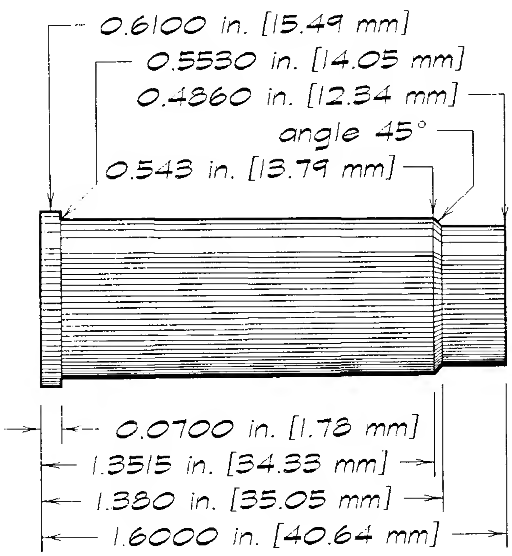


.452 bullet displaces
40.58 grains per inch.

Use factory .454 Casull brass for full loads. Use .45 Colt brass for mild loads only (i e, .45 Colt loads only).

.454 Davis Extra Magnum (designer's specs)

solid:
850 gr brass
100 gr water



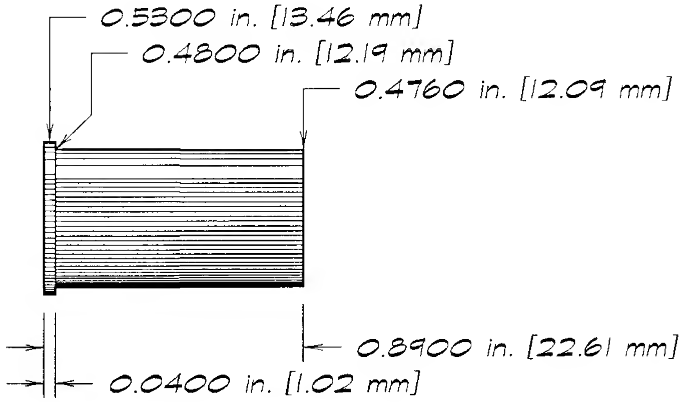
.454 bullet displaces
40.94 grains per inch.

Anneal neck, shoulder, and upper body of .348 Winchester brass. Fire-form with inert filler. Trim to 1.6 inch and deburr.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.455 Colt (Winchester drawing, 1912)

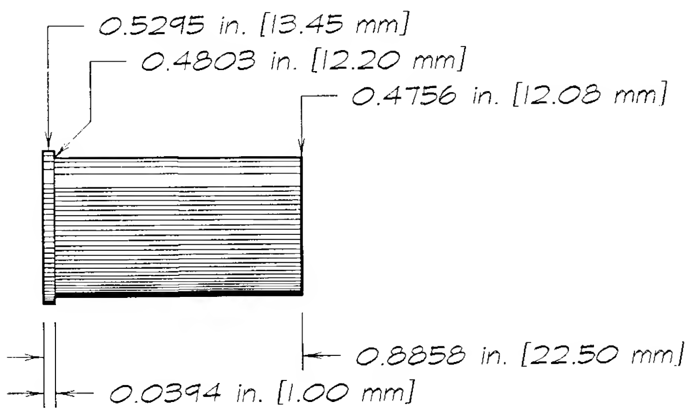
solid:
371 gr brass
44 gr water



Thin the rim of a .45 Colt or .45 Auto Rim to 0.040 inch thick. Trim the case to length and chamfer the mouth. Some shooters find that this thin rim is weak when they seat primers. Having a good pistolsmith cut recesses for the good, husky rim of the .45 Auto Rim sounds like a good idea to me (but what do I know?).

.455 Colt, Eley, Enfield (Triebel maximums)

solid:
370 gr brass
43 gr water



.455 bullet displaces 41.12 grains per inch.

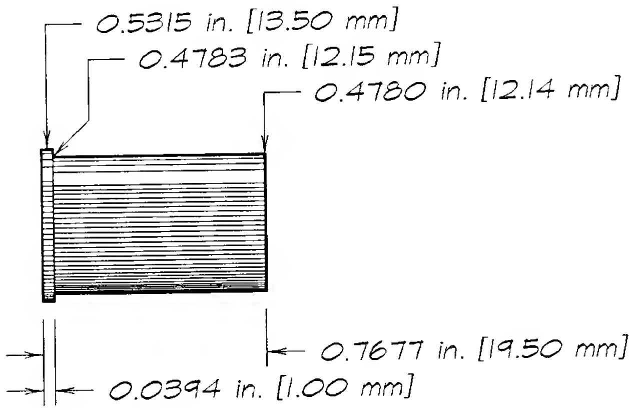
Thin the rim of .45 Colt or .45 Auto Rim to 0.040 inch thick. Trim to 0.89 inch and deburr. Take it easy seating primers -- this thin rim is weak.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.455 Mark II

(CIP maximums)

solid:
323 gr brass
38 gr water



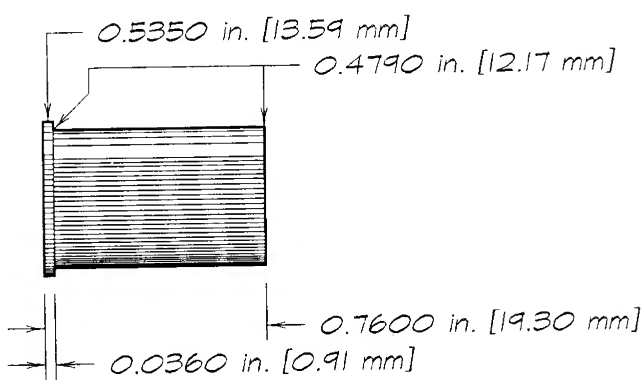
.456 bullet displaces
41.30 grains per inch.

Use factory .455 Mk II (.455 Webley Mk II) brass. Or shorten .45 Auto Rim brass and thin rim (from front, to avoid reducing depth of primer pocket). Deburr.

.455 Revolver

(ICI Metals Ltd dwg)

solid:
324 gr brass
38 gr water



.458 bullet displaces
41.66 grains per inch.

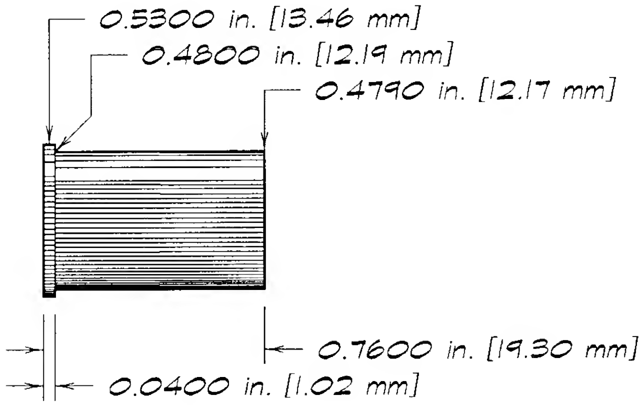
Anneal forward half of Remington .45 Colt brass, trim to 0.76 inch, and deburr. Ream neck if necessary. Thin rim to 0.036 inch (from FRONT only) if necessary.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.455 Webley Mk II

(SAAMI maximums, 1965)

solid:
318 gr brass
37 gr water



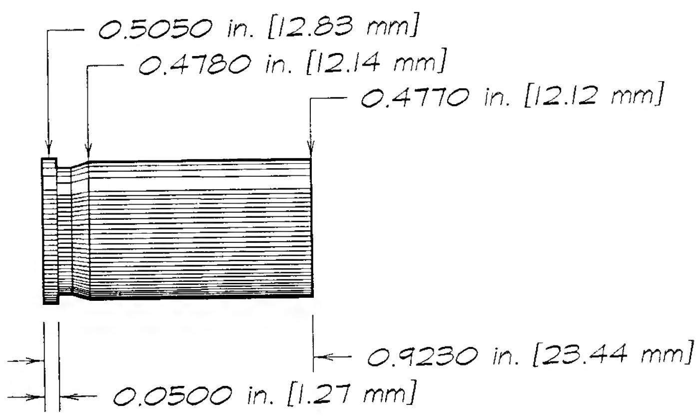
.456 bullet displaces
41.30 grains per inch.

Form from Remington .45 Colt brass, in RCBS form die. Or (with a bit more work) file the rim of .45 Auto Rim brass to 0.04 inch thick and trim case to 0.76 inch.

.455 Webley SL

(ICI Metals Ltd dwg)

solid:
363 gr brass
43 gr water



.455 bullet displaces
41.12 grains per inch.

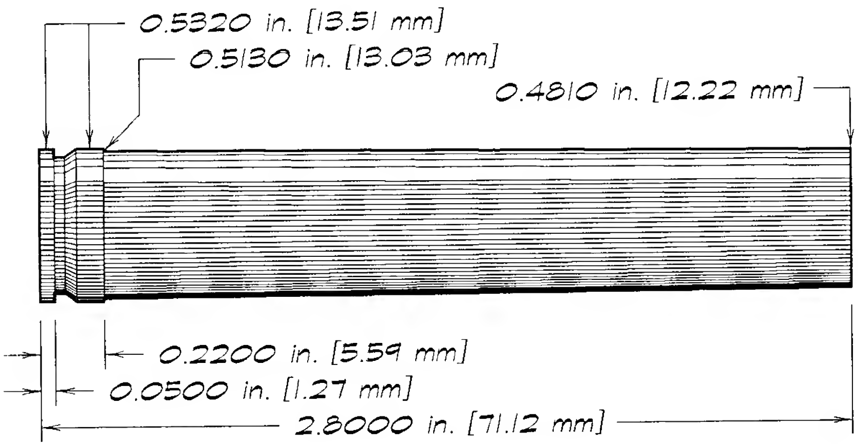
Trim .45 Winchester Magnum brass to 0.923 inch and deburr.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.458 Lott

(unidentified drawing)

solid:
1,230 gr brass
144 gr water



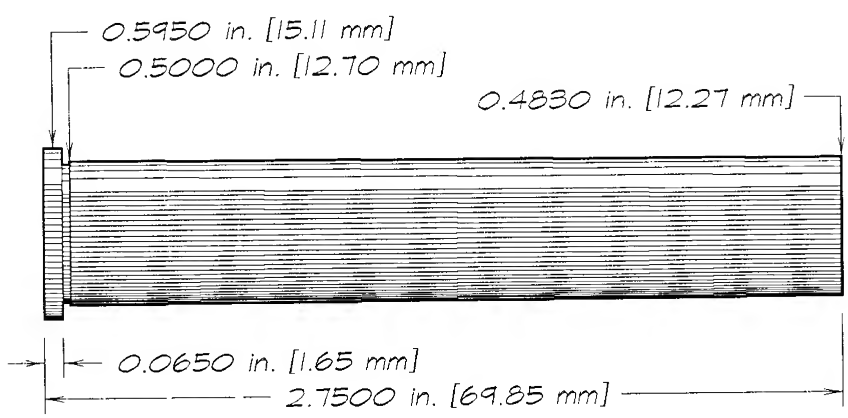
.458 bullet displaces 41.66 grains per inch.

Anneal neck, shoulder, and upper body of .375 H&H Magnum brass and fire-form with inert filler. Trim to 2.8 inches and deburr.

.458 RCBS

(David J LeGate)

solid:
1,126 gr brass
132 gr water



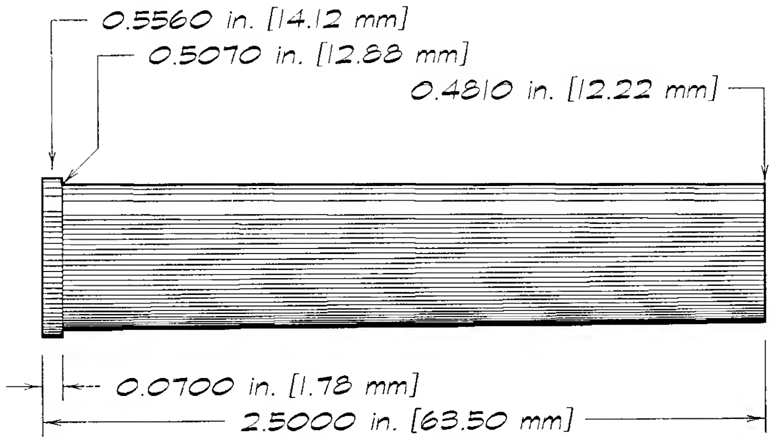
.458 bullet displaces 41.66 grains per inch.

Form from HDS .45 Basic brass, in RCBS form-and-trim die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.458 Siamese Mauser (Davis) (designer's specs)

solid:
1,022 gr brass
120 gr water

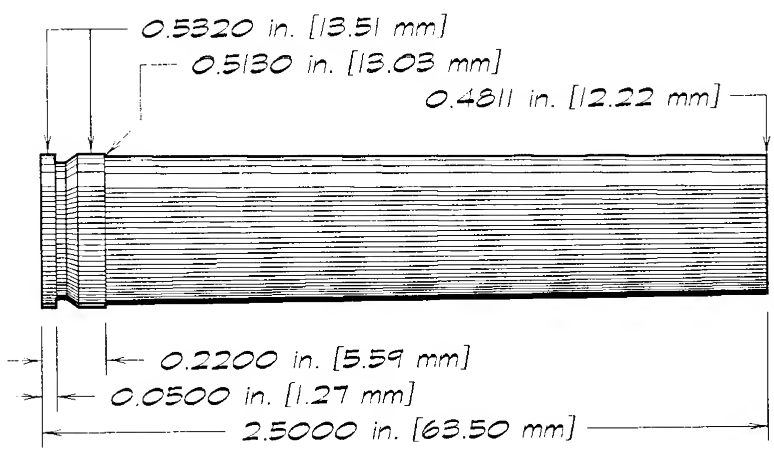


.458 bullet displaces
41.66 grains per inch.

Trim HDS .45 Basic case to 2½ inches. Deburr. Turn rim to 0.556. Resize full-length in .45-90 sizer die.

.458 Winchester Magnum (SAAMI maximums)

solid:
1,099 gr brass
129 gr water

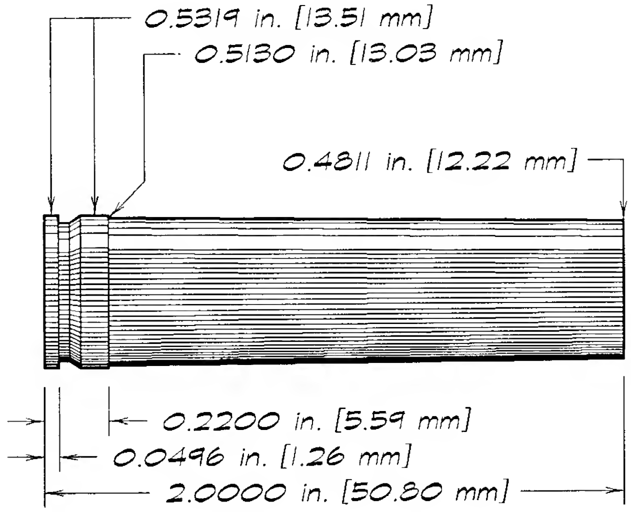


.458 bullet displaces
41.66 grains per inch.

Use .458 Winchester Magnum factory brass. Or trim any other H&H-Magnum-based case that's long enough, to 2½ inches, fire-form with inert filler, and deburr mouth.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.458 2-Inch (Triebel maximums)



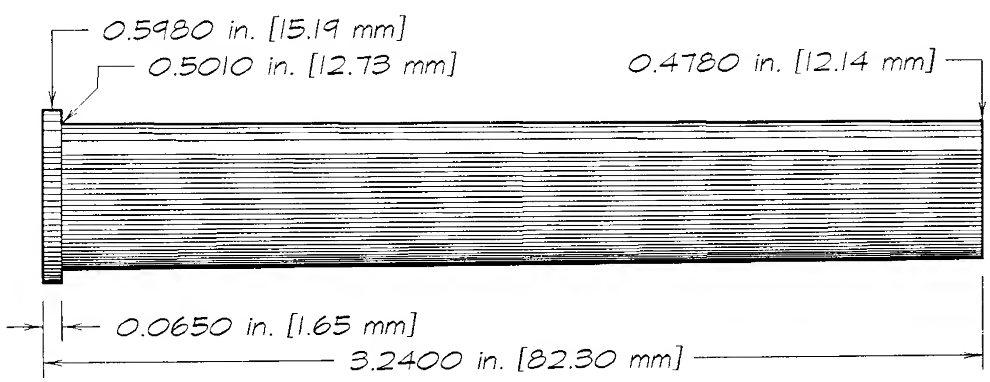
solid:
880 gr brass
103 gr water

.458 bullet displaces 41.66 grains per inch.

Form from .458 Winchester Magnum brass -- or any other H&H-magnum-based brass that's long enough -- in respective RCBS form, trim, and ream dies.

.458 3¼-Inch 500 (loaded round)

solid:
1,326 gr brass
156 gr water



.458 bullet displaces 41.66 grains per inch.

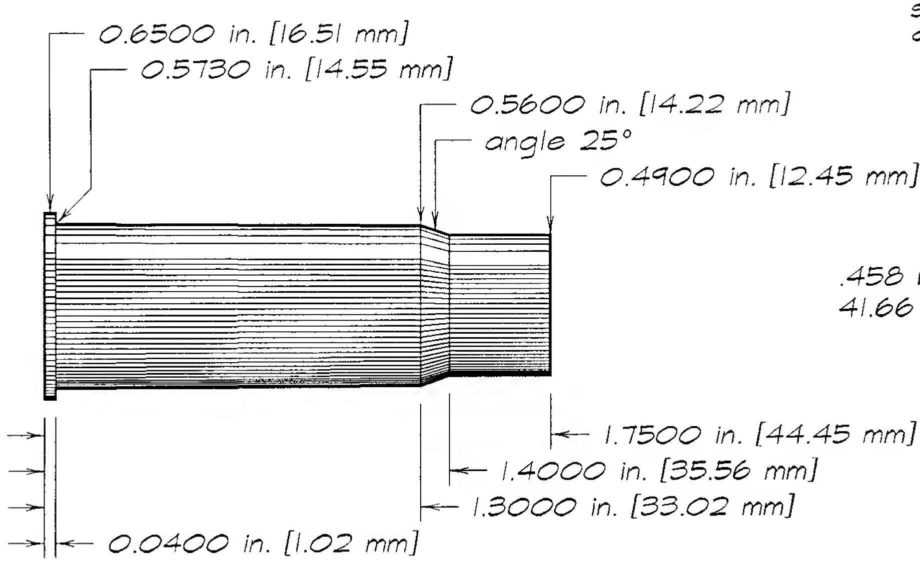
Use RCBS .45 Basic brass.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.460 Jurras

(Jurras drawing)

solid:
943 gr brass
111 gr water



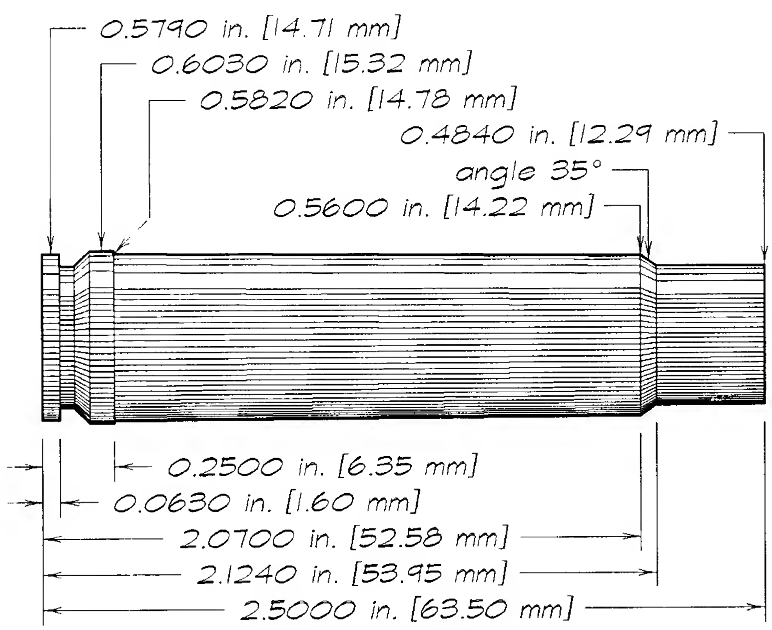
.458 bullet displaces 41.66 grains per inch.

Anneal upper body of .500 Nitro Express brass. Form and trim in RCBS form-and-trim die. Ream inside neck, in RCBS neck-ream set. Fire-form with inert filler.

.460 Short A-Square

(A-Square maximums)

solid:
1,349 gr brass
158 gr water



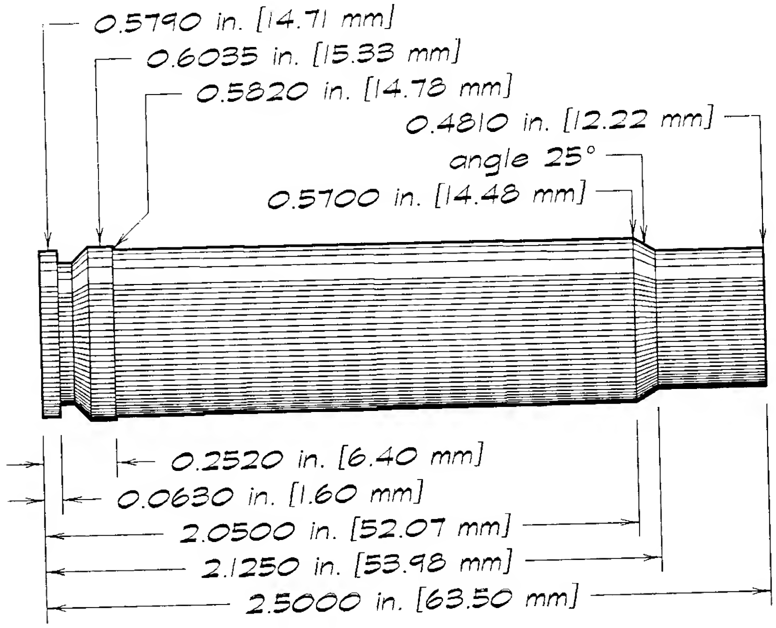
.458 bullet displaces 41.66 grains per inch.

Use A-Square or A-Cube factory brass. Or anneal neck and shoulder of .378 Weatherby Magnum or .460 Weatherby Magnum brass; trim to 2½ inches; resize full-length in .460 Short A-Square sizer die; fire-form with inert filler; ream inside neck (if necessary) in RCBS neck-ream die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.460 Van Horn

(David J LeGate)



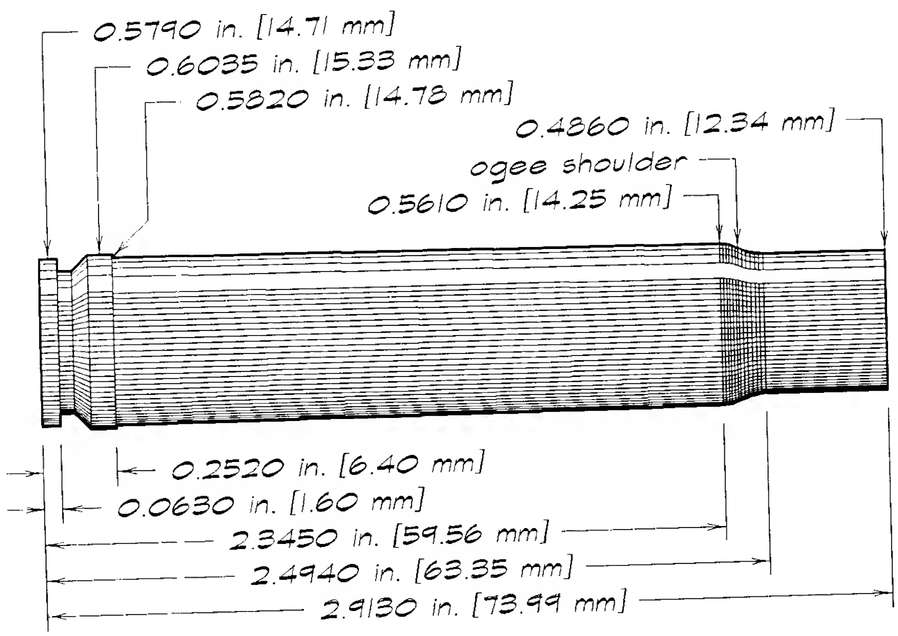
solid:
1,358 gr brass
159 gr water

.458 bullet displaces
41.67 grains per inch.

Shorten .460 Weatherby Magnum brass to 2.6 inches. Resize full-length in .460 Van Horn sizer die. Trim to 2.500 inches and deburr.

.460 Weatherby Magnum

(SAAMI maximums, 1986)



solid:
1,571 gr brass
184 gr water

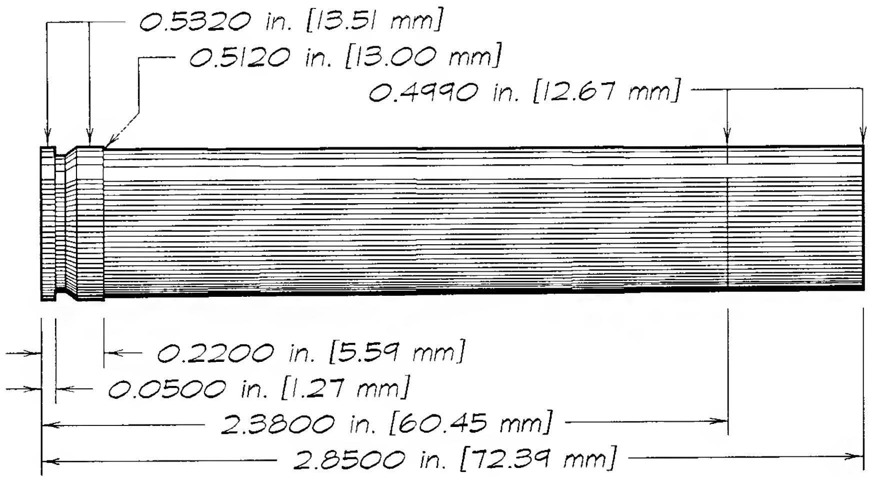
.458 bullet
displaces
41.66 grains
per inch.

Fire-form .378 Weatherby Magnum case with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.470 Capstick (A-Square maximums)

solid:
1,265 gr brass
148 gr water

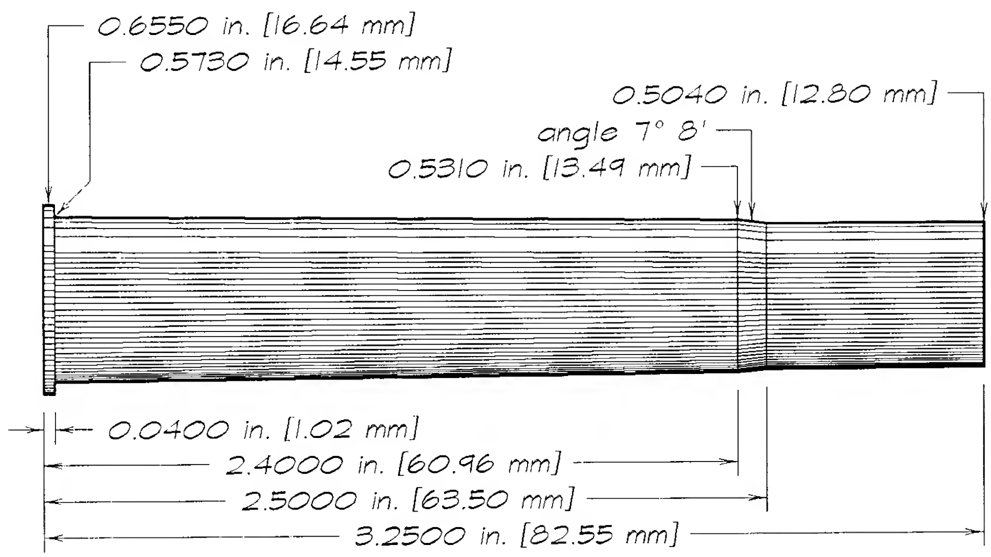


.475 bullet displaces
44.81 grains per inch.

Use A-Square or A-Cube factory brass. Or anneal neck and shoulder of .375 H&H Magnum brass and fire-form with inert filler.

.470 Nitro Express (ICI Metals Ltd dwg)

solid:
1,625 gr brass
191 gr water



.474 bullet
displaces
44.62
grains
per inch.

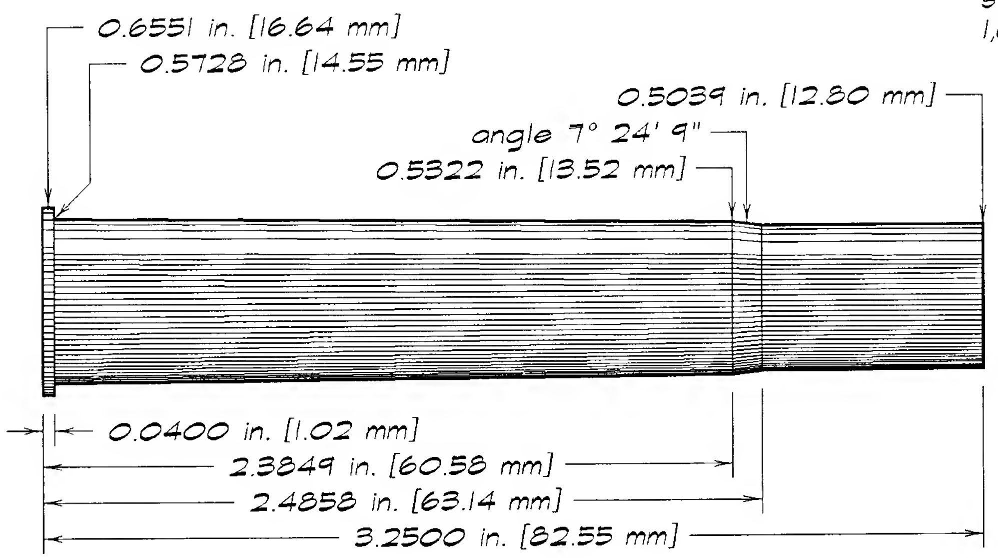
Use factory .470 NE brass. Or form from .500 NE or .500 Basic brass, in the respective RCBS form dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.470 Nitro Express

(SAAMI maximums)

solid:
1,625 gr brass
191 gr water



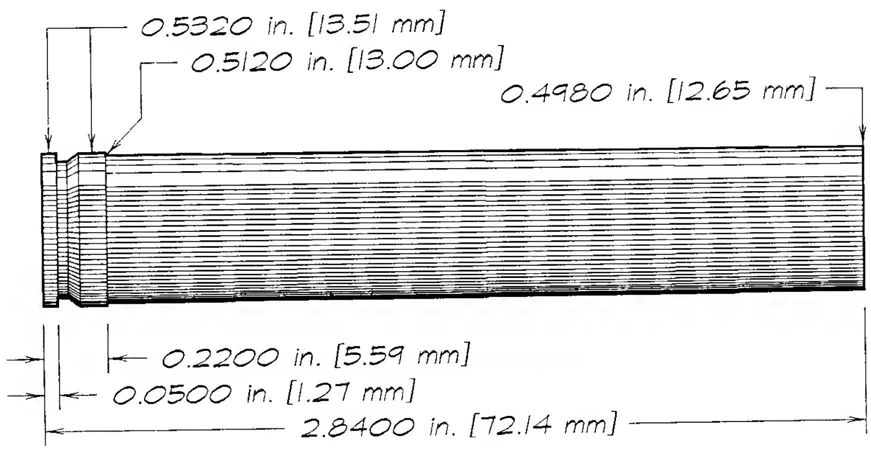
.474 bullet displaces 44.62 grains per inch.

Use .470 Nitro Express brass. Or form from Kynoch .500 Nitro Express or .500 Basic brass, in respective RCBS form dies.

.475 OKH

(C M O'Neil specimen)

solid:
1,263 gr brass
148 gr water



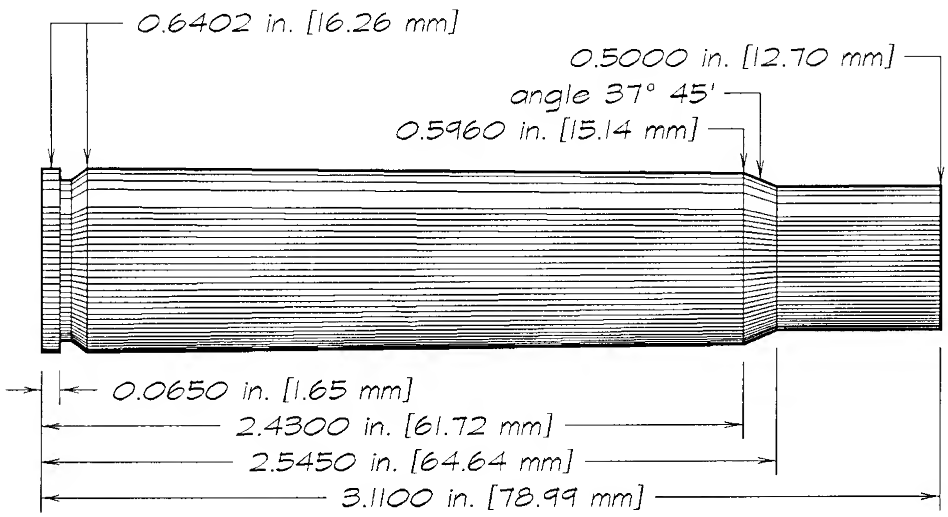
.475 bullet displaces 44.81 grains per inch.

Use A-Square or A-Cube .470 Capstick brass. Or anneal neck and shoulder of .375 H&H Magnum brass and fire-form with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.470 Royal (Royal Arms specs)

solid:
1,889 gr brass
222 gr water

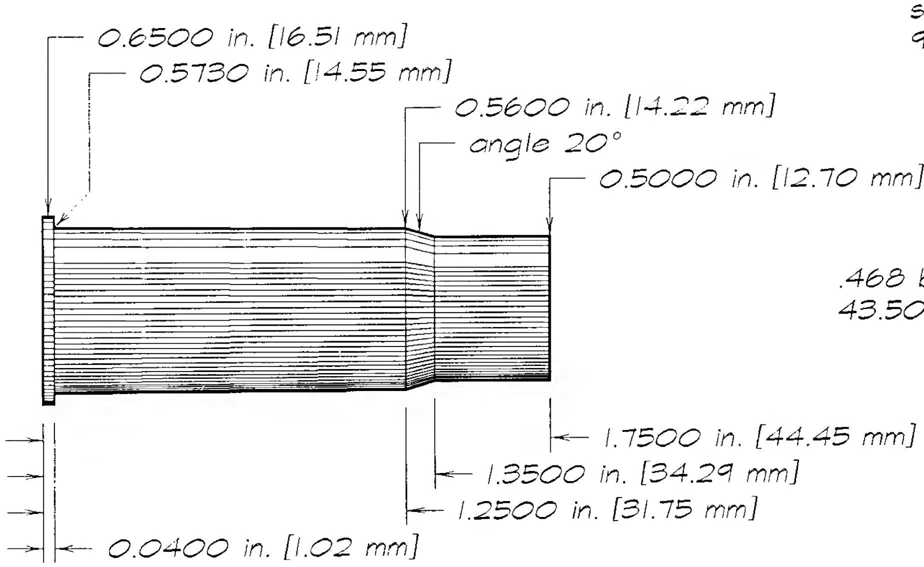


.475 bullet displaces 44.81 grains per inch.

Resize .505 Gibbs brass full-length in .470 Royal sizer die. Or form from .505 Gibbs Basic brass, in RCBS form die.

.475 Jurras (Jurras drawing)

solid:
937 gr brass
110 gr water

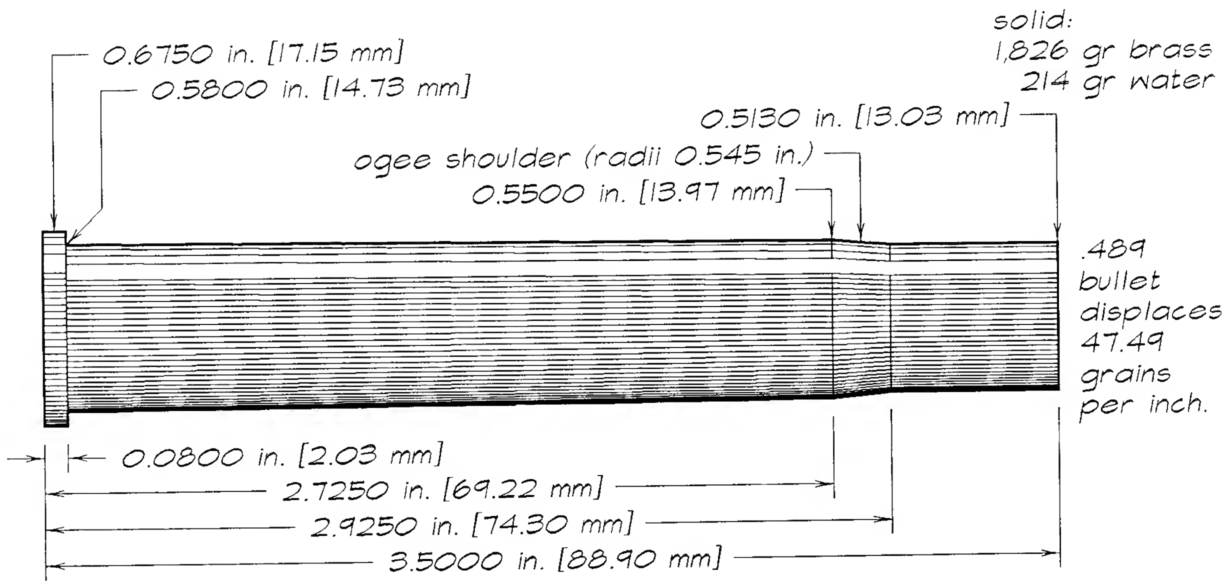


.468 bullet displaces 43.50 grains per inch.

Anneal upper body of .500 Nitro Express brass. Form and trim in RCBS form-and-trim die. Ream inside neck, in RCBS neck-ream set. Fire-form with inert filler.

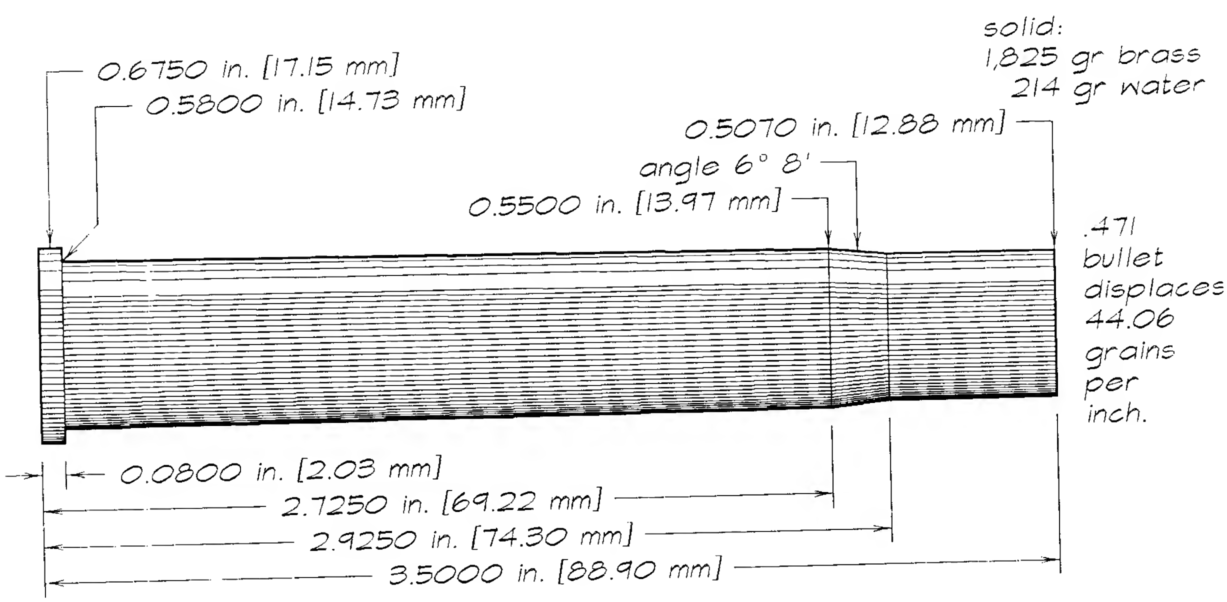
Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.475 Number 2 Nitro Express Jeffery (ICI Metals Ltd dwg)



Use .475 No. 2 NE brass. Or form from .475 No. 2 NE Basic brass, in RCBS form-and-trim die.

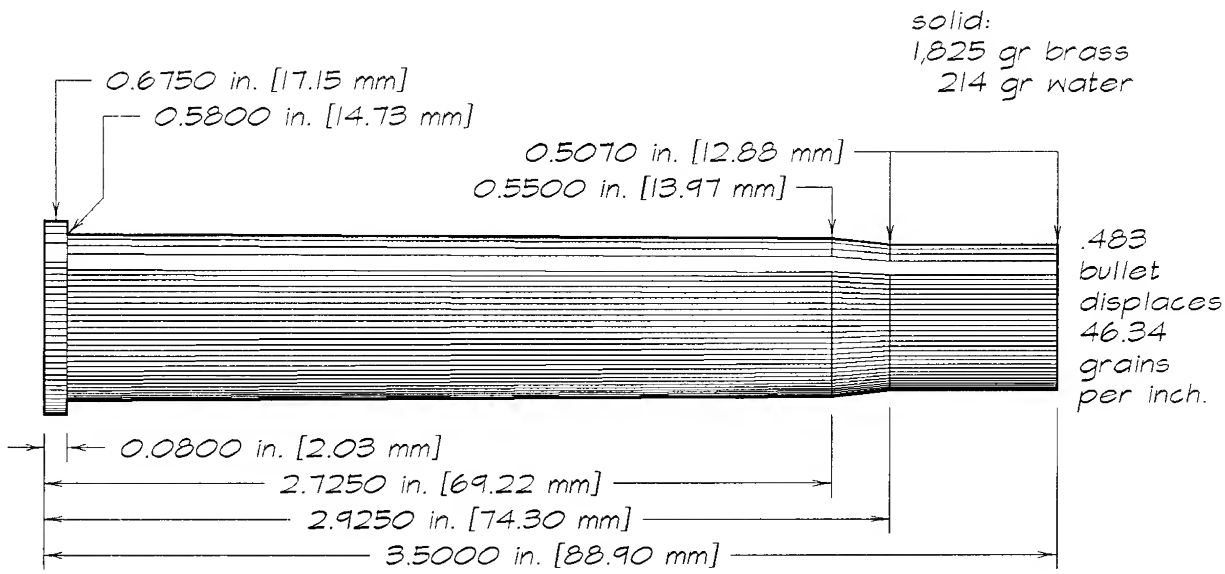
.475 No. 2 Kynoch (ICI Metals dwg, 1935)



Use .475 No. 2 NE brass (same case, different name). Or form from .475 No. 2 NE Basic brass, in RCBS form-and-trim die.

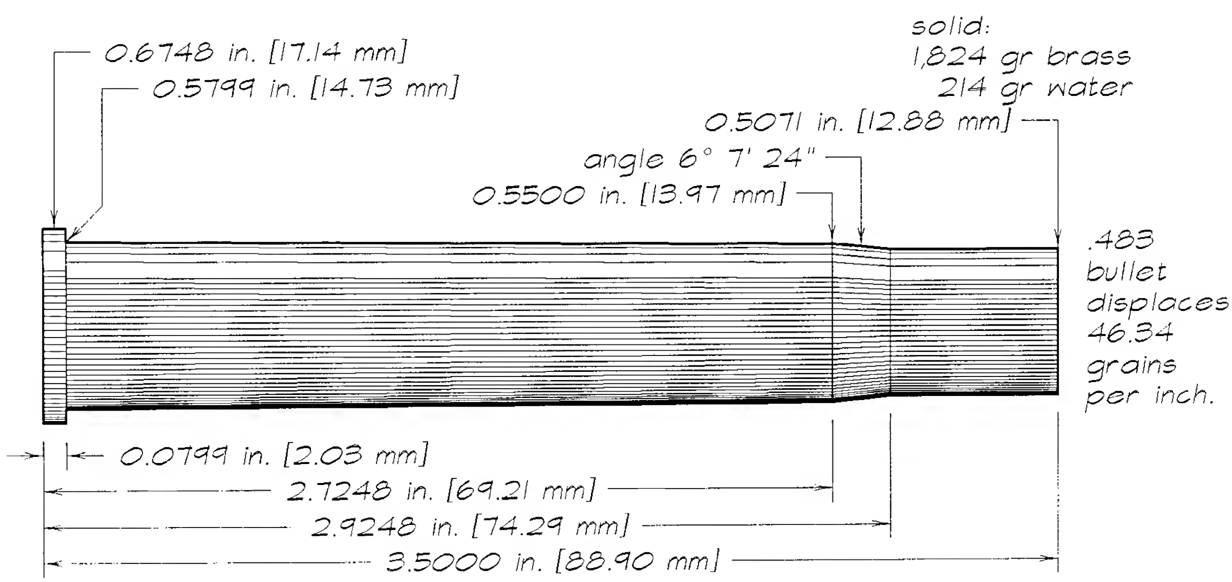
Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.475 Number 2 Nitro Express (Birmingham Proof House)



Use factory .475 No. 2 NE brass. Or form from .475 No. 2 NE Basic brass, in RCBS form-and-trim die.

.475 Number 2 Nitro Express 3½-Inch (CIP maximums)



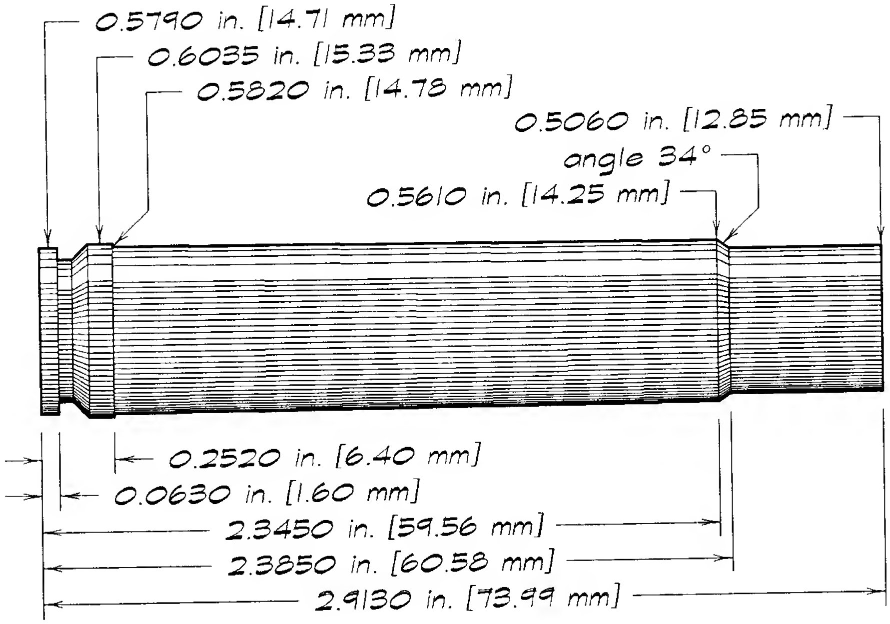
Use factory .475 No. 2 NE brass. Or form from .475 No. 2 NE Basic brass, in RCBS form-and-trim die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.475 Weatherby Magnum

(designer's specs)

solid:
1,571 gr brass
184 gr water



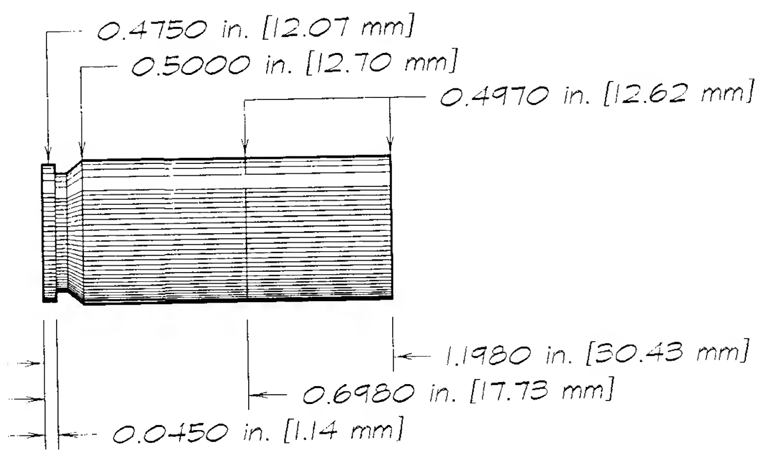
.483 bullet displaces 46.34 grains per inch.

Fire-form .460 Weatherby brass with inert filler.

.475 Wildey Magnum

(Wildey, Inc, drawing)

solid:
486 gr brass
57 gr water

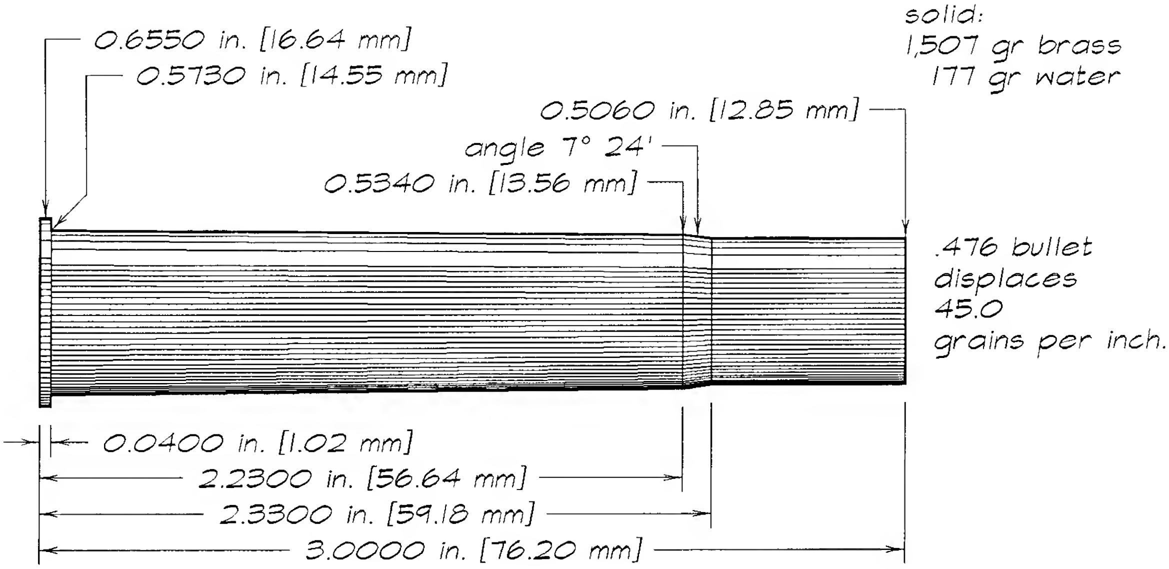


.475 bullet displaces 44.81 grains per inch.

Anneal upper body of .284 Winchester brass, WITH BASE WELL PROTECTED FROM HEAT. Form in RCBS form, trim, and ream dies (with special shell holder). Deburr.

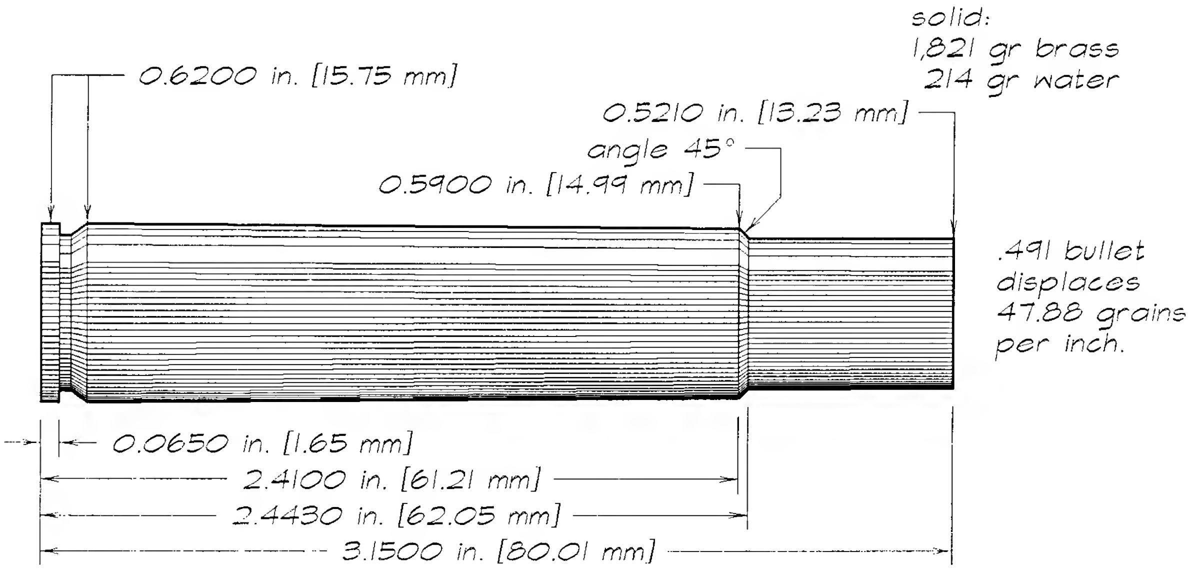
Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.476 Westley Richards (ICI Metals dwg, 1950)



Form from .470 Nitro Express, .500 NE 3¼-Inch, or .500 Basic brass, in respective RCBS form die.

.480 Gibbs (Kynoch drawing, 1913)

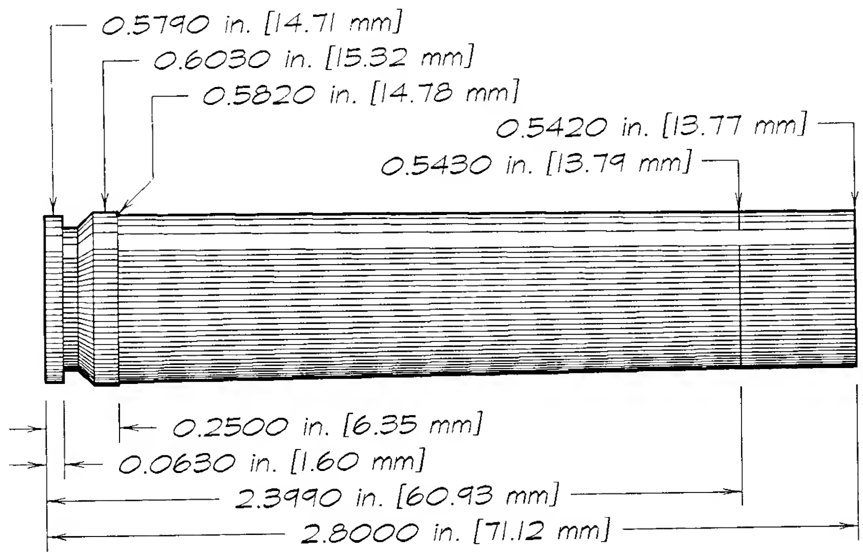


Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.495 A-Square

(A-Square maximums)

solid:
1,559 gr brass
183 gr water



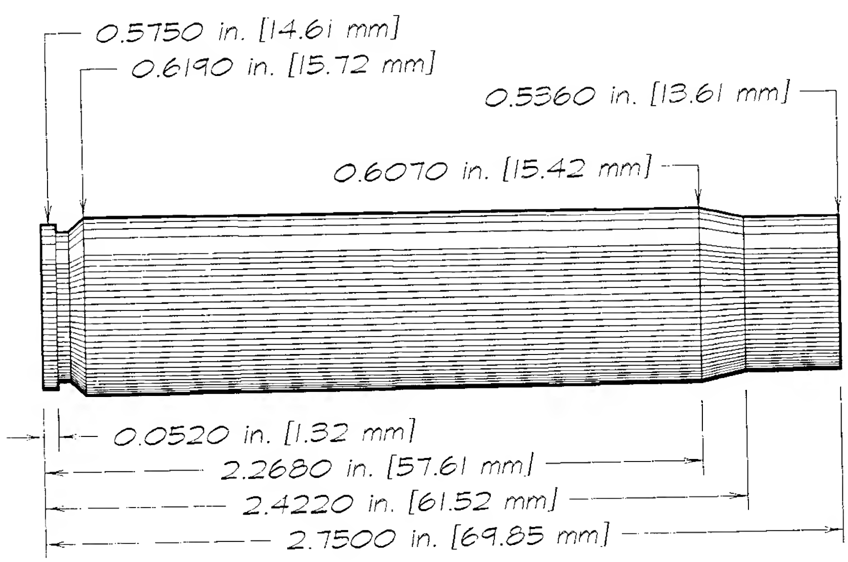
.510 bullet displaces 51.66 grains per inch.

Use A-Square or A-Cube factory brass. Or anneal neck and shoulder of .378 Weatherby Magnum or .460 Weatherby Magnum brass and fire-form with inert filler. Trim to 2.8 inches and deburr.

.5 Jeffery

(Kynoch drawing, 1928)

solid:
1,679 gr brass
197 gr water



.510 bullet displaces 51.66 grains per inch.

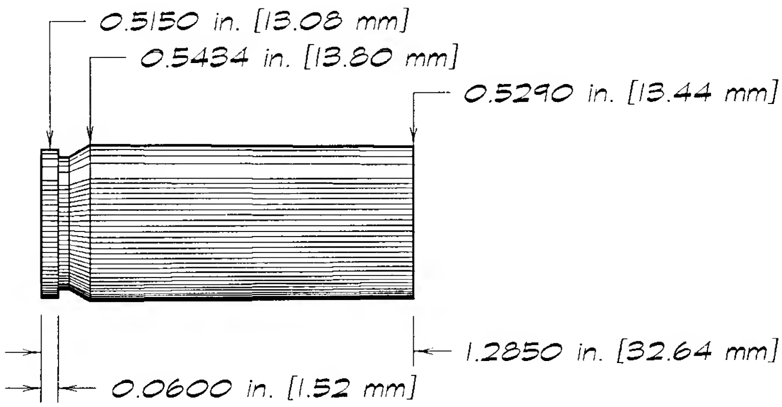
Form from .505 Gibbs Basic brass, in RCBS form and trim dies.
Fire-form with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.50 Action Express

(SAAMI maximums)

solid:
613 gr brass
72 gr water



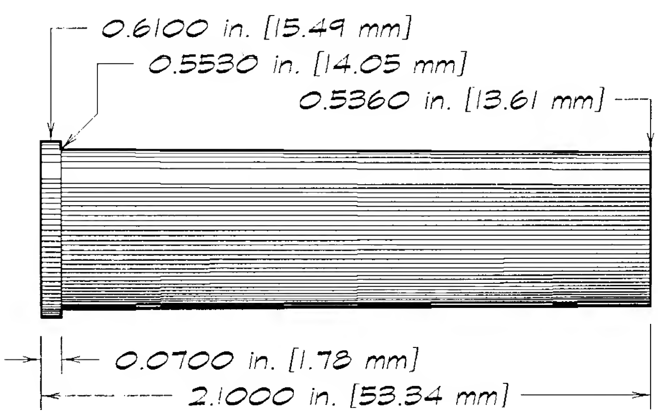
.502 bullet displaces
50.05 grains per inch.

Use factory .50 Action Express brass.

.50 Alaskan (.50-.348)

(David J LeGate)

solid:
1,139 gr brass
134 gr water



.512 bullet displaces
52.07 grains per inch.

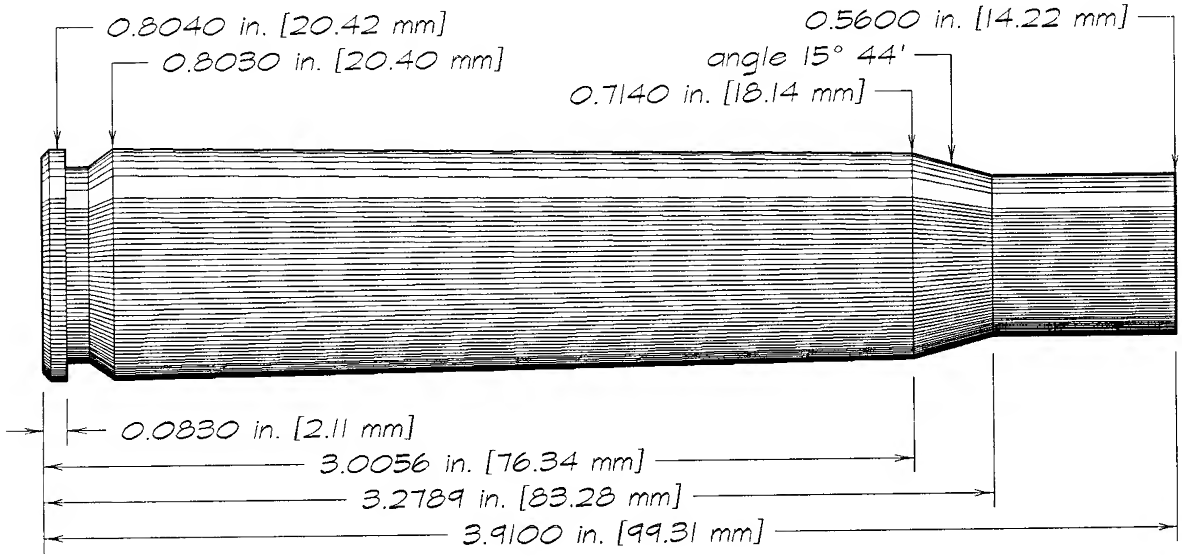
Anneal neck, shoulder, and upper body of .348 Winchester brass. Fire-form with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.50 Browning (.50 BMG)

(Frankford Arsenal dwg)

solid: 3,519 gr brass
413 gr water

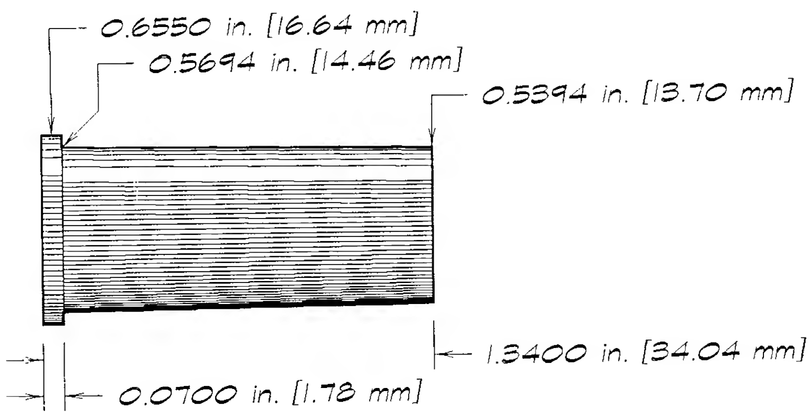


The only case to use for this one is the .50 Browning, which has recently become the parent case for a number of wildcat cartridges.

.50 Carbine (".50 U. S. Carbine")

(Winchester drawing, 1912)

solid:
702 gr brass
82 gr water



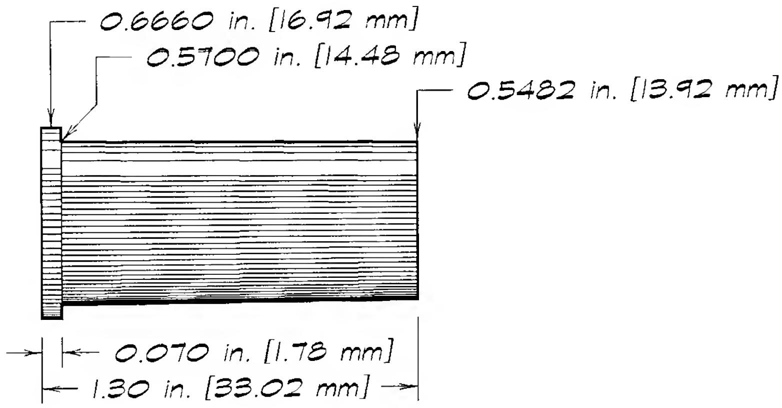
.515 bullet displaces
52.68 grains per inch.

Form from .348 Winchester or .50 Sharps Basic brass, in respective RCBS form, trim, and ream dies. (Protect head of case when annealing body.) Fire-form.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.50 Crum (designer's specs)

solid:
681 gr brass
80 gr water

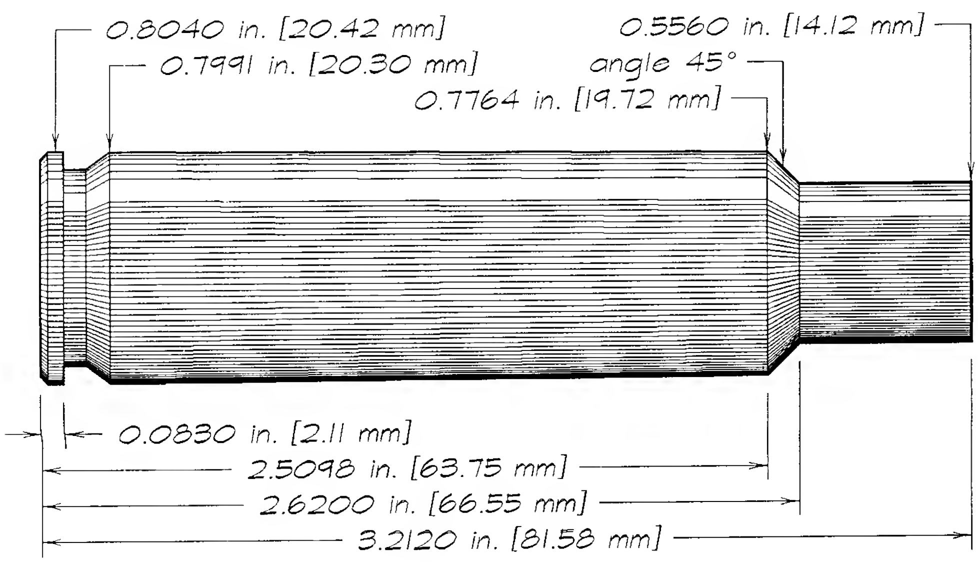


.512 bullet displaces
52.07 grains per inch.

Anneal neck, shoulder, and upper body of .348 Winchester or .50 Sharps Basic brass -- with base WELL PROTECTED FROM HEAT -- and form in respective RCBS form, trim, and ream dies. Deburr.

.50 BMG/Fisher (designer's specimen)

solid:
2,985 gr brass
350 gr water

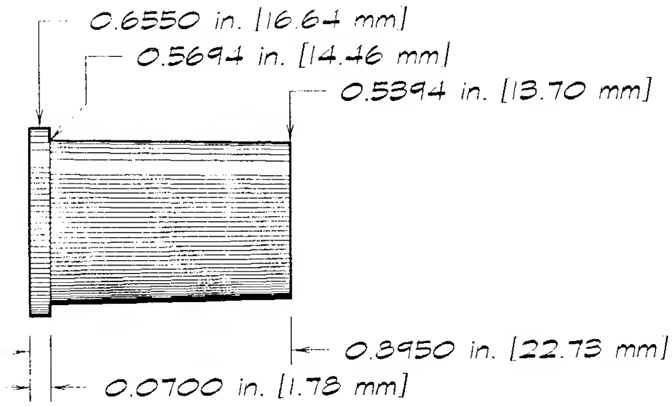


Anneal shoulder of .50 Browning brass. Form in oversize RCBS form, trim, and ream dies, in oversize press. Deburr. Fire-form with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.50 Pistol (Navy and commercial versions) (Winchester drawing 1913)

solid:
474 gr brass
56 gr water

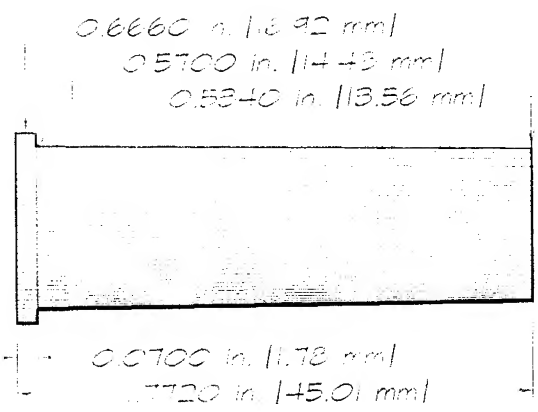


.508 bullet displaces
51.26 grains per inch.

Anneal neck, shoulder, and upper body of .50 Sharps Basic brass and form in RCBS form, trim, and ream dies. Deburr.

.50 Sporting (Winchester drawing 1912)

solid:
913 gr brass
108 gr water

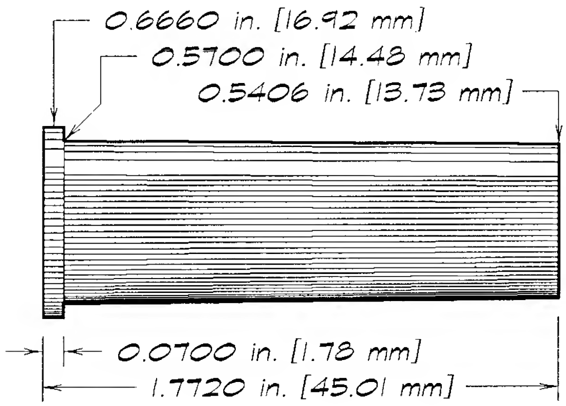


Form from .50 Sharps Basic brass, in RCBS form-and-trim die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.50-70 Government (Winchester drawing, 1912)

solid:
921 gr brass
108 gr water

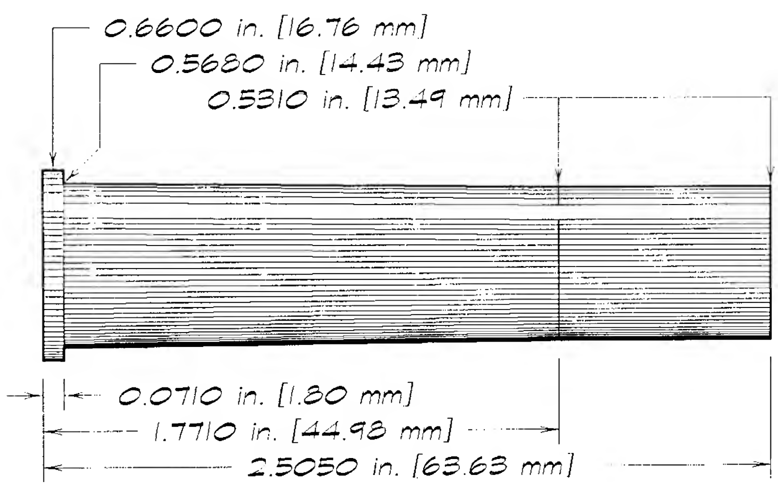


.513 bullet displaces
52.27 grains per inch.

Use recently manufactured .50-70 brass. Or form from .348 Winchester or .50 Sharps Basic brass, in respective RCBS form and trim dies.
The 1912 Winchester factory drawing specifies the above dimensions but also for some reason shows these alternate dimensions scribbled in: diameter ahead of rim 0.568 inch; outside diameter at mouth 0.535 inch; case length 1.770 inch.

.50-90-473 Sharps Special (Winchester drawing, 1912)

solid:
1,264 gr brass
148 gr water



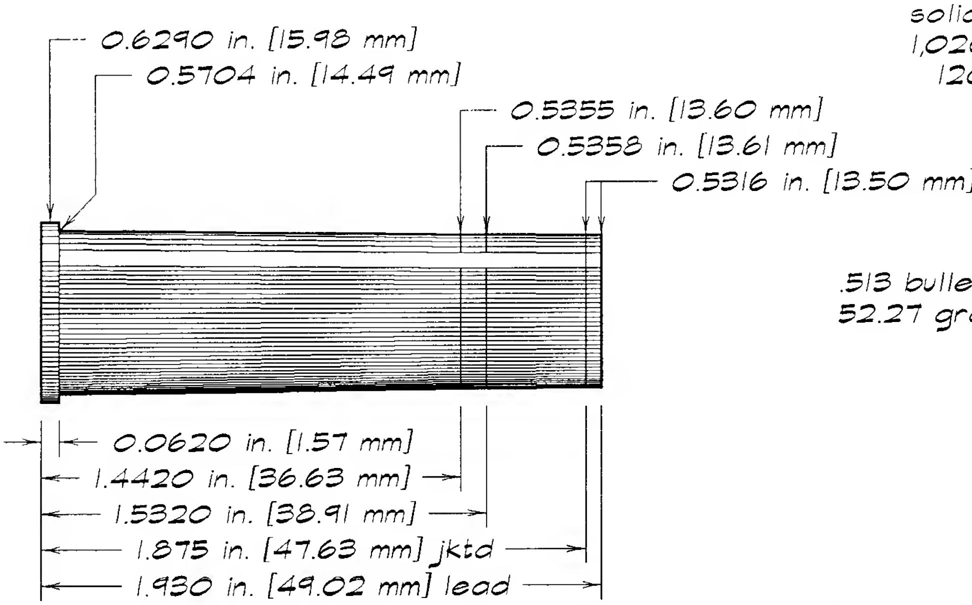
.509 bullet displaces
51.46 grains per inch.

Form from .50 Sharps Basic brass, in RCBS form die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.50-95 Winchester Express (Winchester drawing, 1912)

solid:
1,020 gr brass
120 gr water

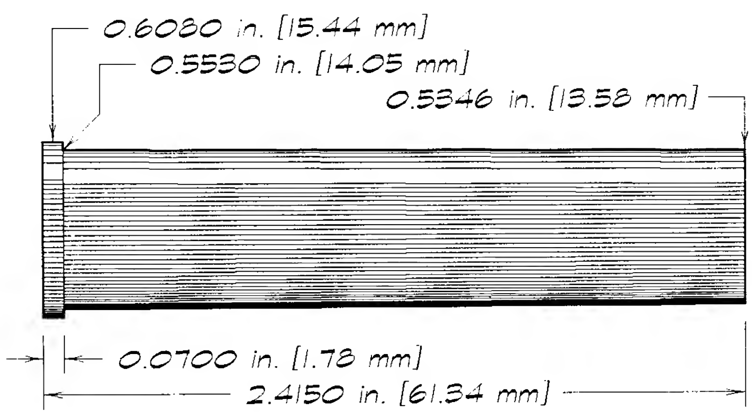


.513 bullet displaces
52.27 grains per inch.

Form from .50 Sharps Basic brass, in RCBS form die. For their ammunition in 1912, Winchester specified different case lengths for use with jacketed (1.875 in.) and lead (1.930 in.) bullets. I'd use the longer dimension for both jacketed and cast bullets at first, then trim back to the shorter dimension when case necks start to split at the mouth -- if they didn't split too far back.

.50-100-450 Winchester (Winchester drawing, 1912)

solid:
1,304 gr brass
153 gr water



.512 bullet displaces
52.07 grain per inch.

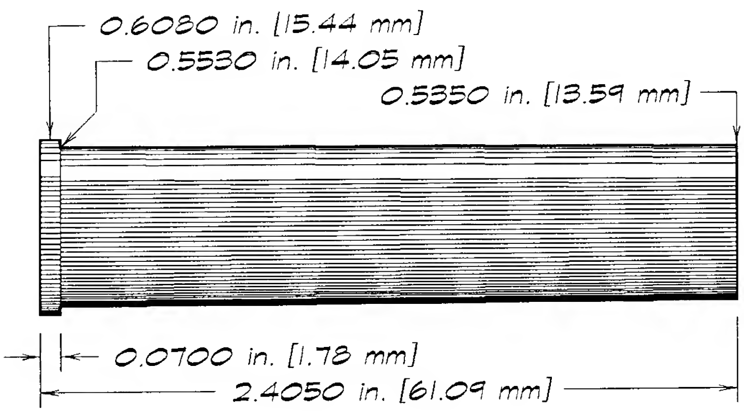
Anneal neck, shoulder, and upper body of .348 Winchester and fire-form with inert filler. Or from from .50 Sharps Basic brass, in RCBS form and trim dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.50-105 Winchester

(Winchester drawing, 1912)

solid:
1,300 gr brass
152 gr water



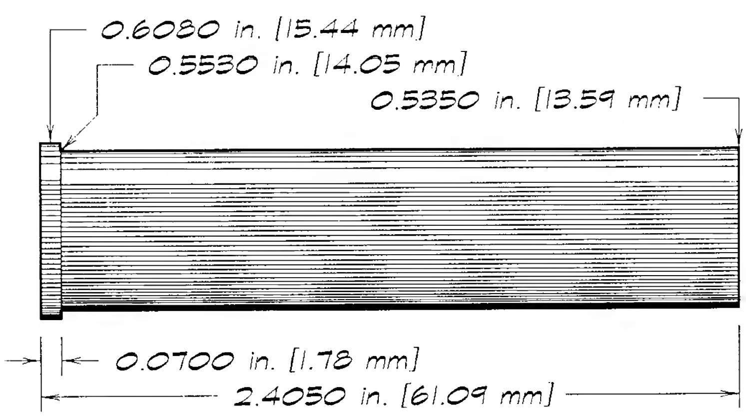
.512 bullet displaces
52.07 grains per inch.

Form from .50 Sharps Basic brass, in RCBS form and trim dies. Or anneal neck, shoulder, and upper body of .348 Winchester brass and fire-form with inert filler.

.50-110 Winchester Express

(Winchester drawing, 1912)

solid:
1,353 gr brass
159 gr water

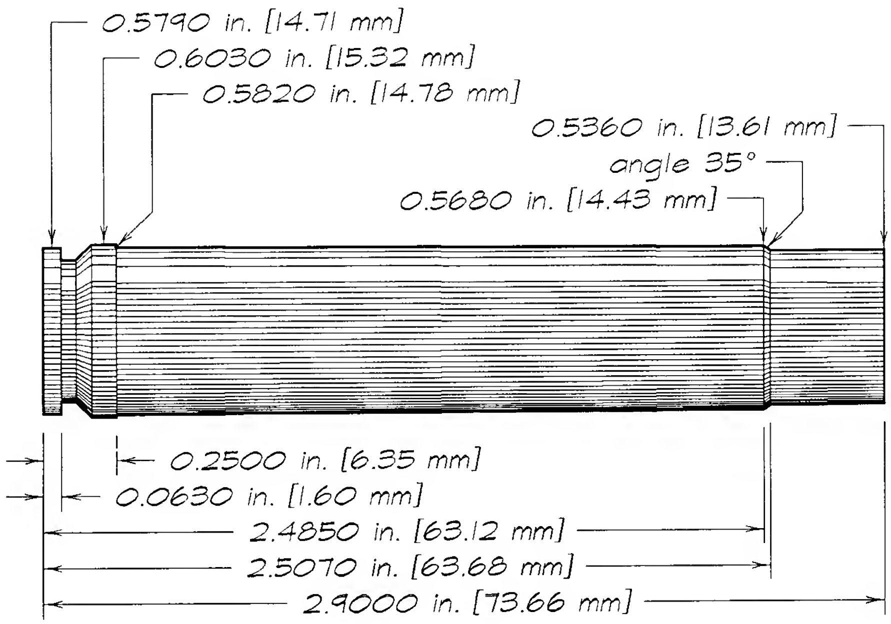


.512 bullet displaces
52.07 grains per inch.

Use recently manufactured .50-110 brass. Or form from .348 Winchester or .50 Sharps Basic brass, in respective RCBS form die. This is the same case, by the way, as the .50-100 and .50-105 Winchester, according to Winchester's drawings.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.500 A-Square (A-Square maximums)



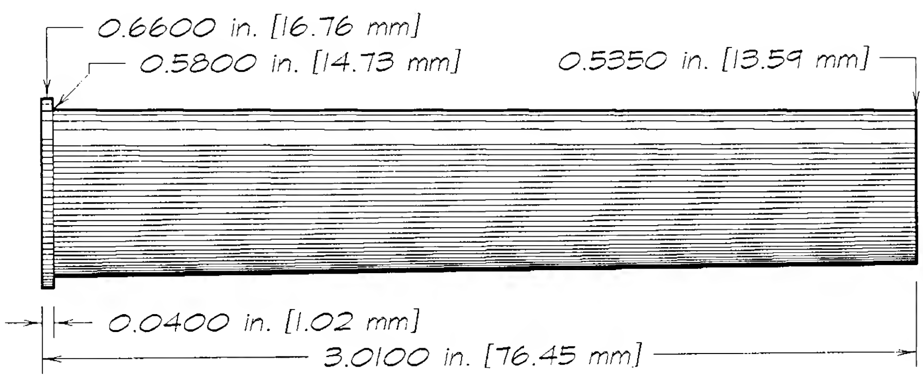
solid:
1,632 gr brass
191 gr water

.510 bullet displaces 51.66 grains per inch.

Use A-Square or A-Cube factory brass. Or anneal neck and shoulder of .378 Weatherby Magnum or .460 Weatherby Magnum brass. Fire-form with inert filler.

.500 Express (Kynoch drawing, 1884)

solid:
1,593 gr brass
187 gr water

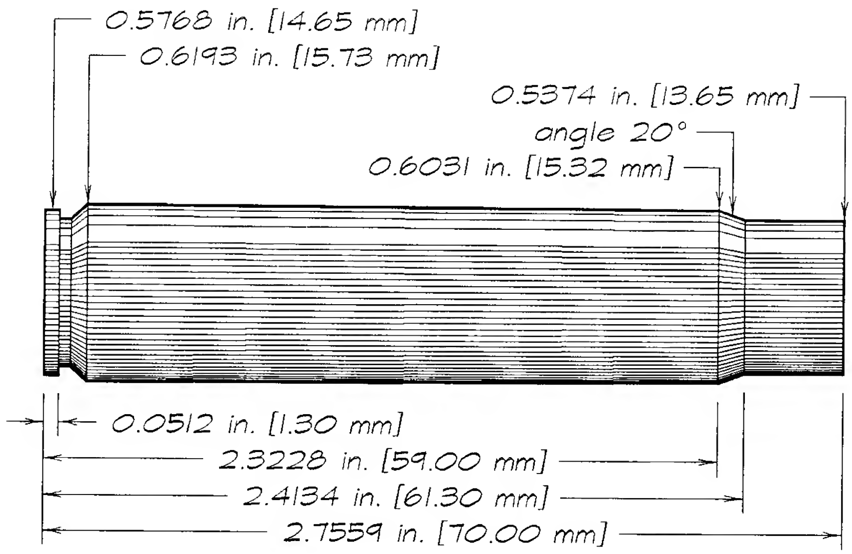


Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.500 Jeffery Rimless (12.5x70mm Schuler)

(Triebel maximums)

solid:
1,679 gr brass
197 gr water



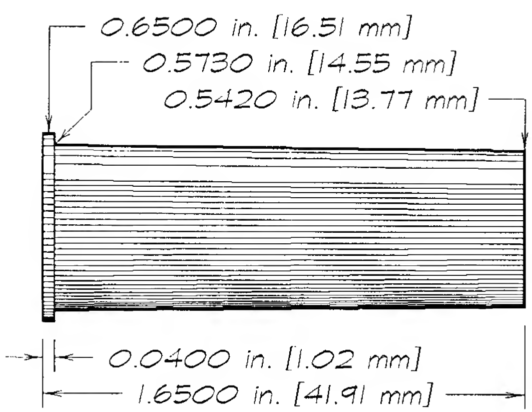
.508 bullet displaces
51.26 grains per inch.

Use recently manufactured .500 Jeffery brass. Or form from .505 Gibbs Basic brass, in RCBS form die.

.500 Jurras

(Jurras drawing)

solid:
881 gr brass
103 gr water



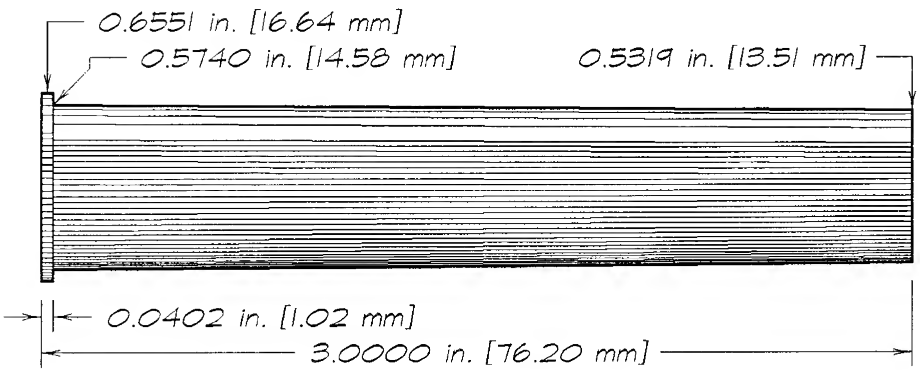
.510 bullet displaces
51.66 grains per inch.

Anneal upper body of .500 Nitro Express brass. Form and trim in RCBS form-and-trim die. Ream inside neck, in RCBS neck-ream die. Fire-form with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.500 Nitro Express 3-Inch (CIP maximums)

solid:
1,558 gr brass
183 gr water

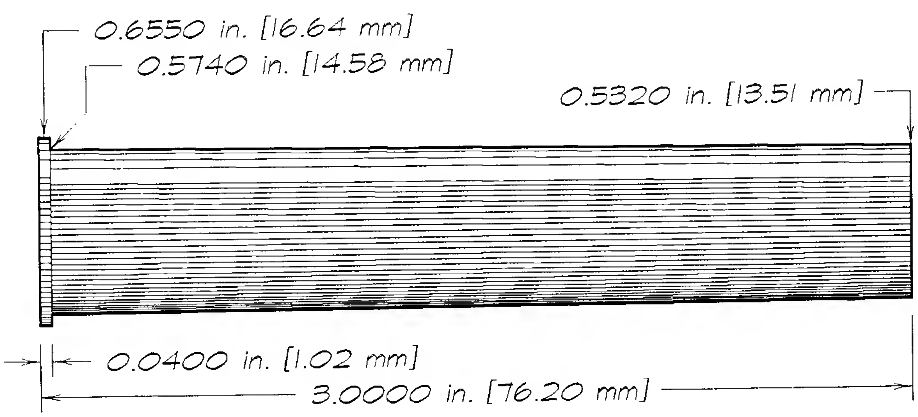


.510 bullet displaces 51.66 grains per inch.

Use factory .500 NE 3-Inch brass. Or trim .500 NE Basic brass to 3.0 inches, deburr, and size full-length in .500 NE 3-Inch sizer die.

.500 Nitro Express 3-Inch (ICI Metals Ltd dwg)

solid:
1,559 gr brass
183 gr water



.510 bullet displaces 51.66 grains per inch.

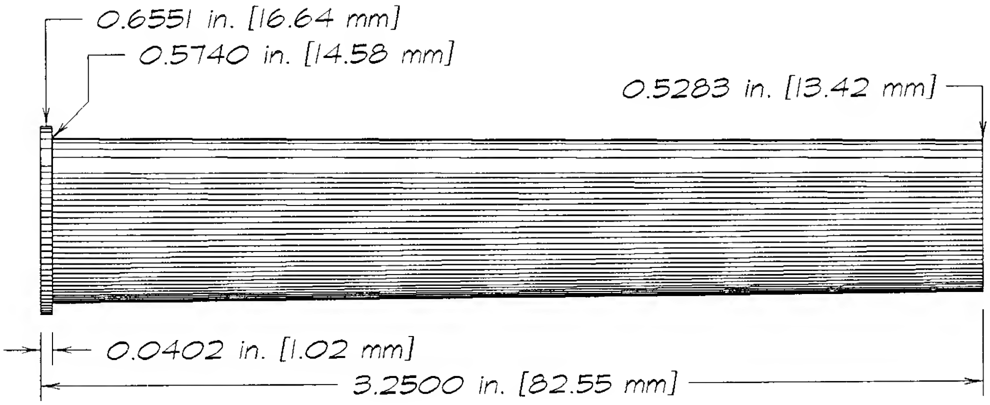
Use factory .500 NE 3-Inch brass. Or trim .500 NE Basic brass to 3.0 inches, deburr, and resize full-length in .500 NE 3-Inch sizer die.

Anneal only by method shown in text.   Text explains use of "solid" and displacement figures.

.500 Nitro Express 3¼-Inch

(extrapolated from CIP maximums for .500 NE 3-Inch case)

solid:
1,678 gr brass
197 gr water



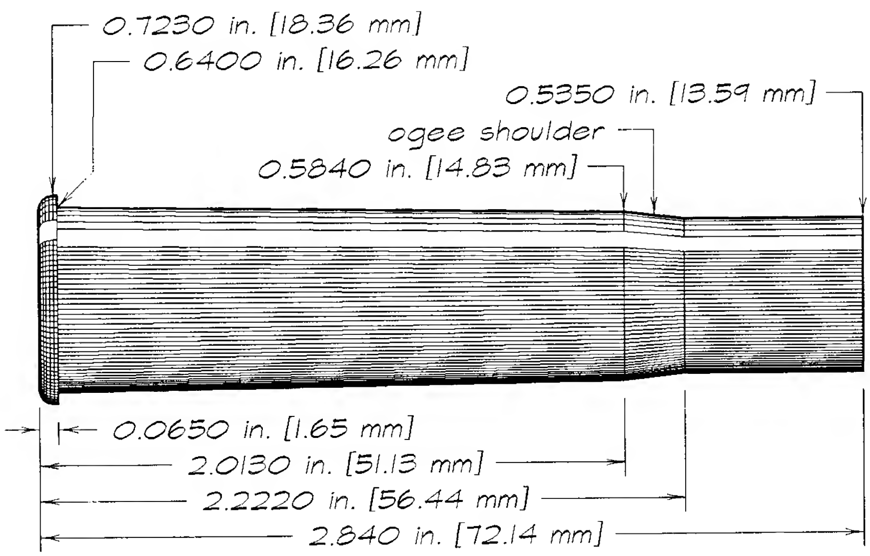
.510 bullet displaces 51.66 grains per inch.

Form from .500 Basic brass, in RCBS form die.

.500 No. 2 Westley Richards Express

(Kynoch drawing, 1884)

solid:
1,719 gr brass
202 gr water

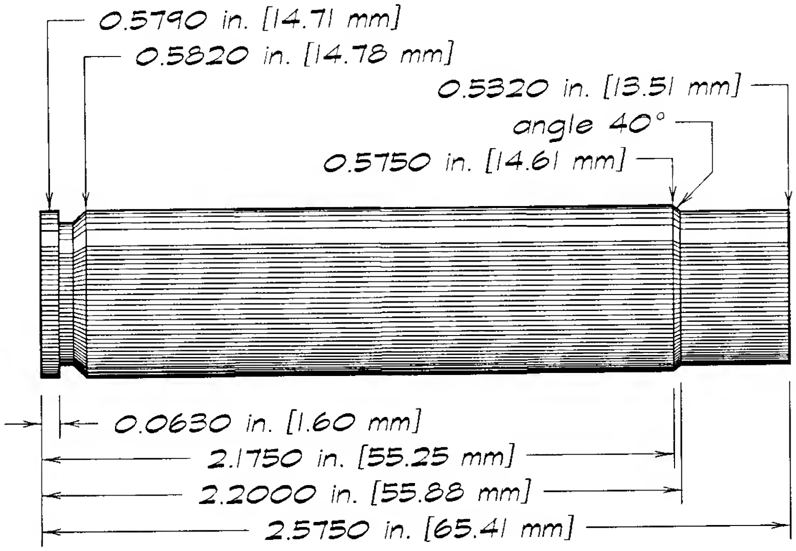


Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.500 Van Horn Express

(designer's specs)

solid:
1,412 gr brass
166 gr water



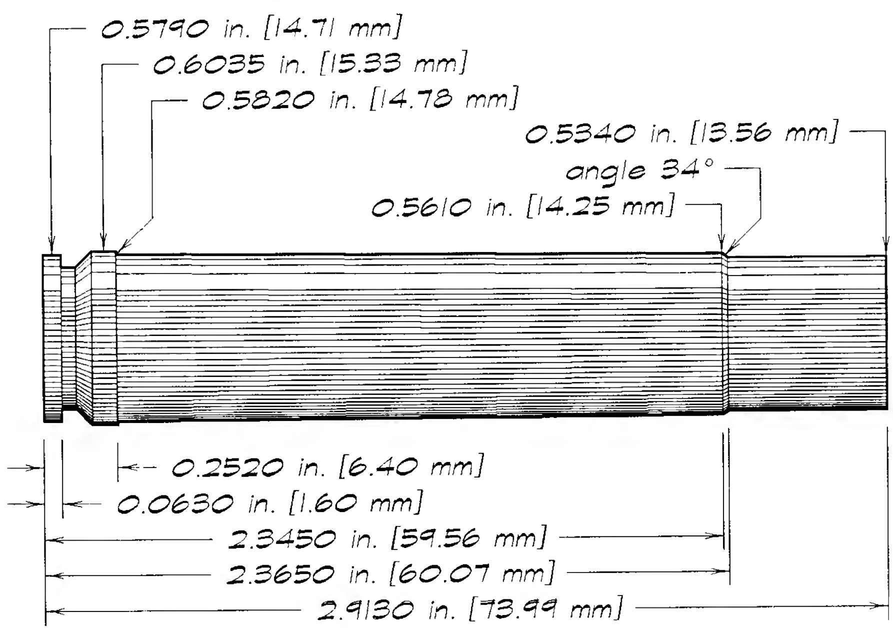
.510 bullet displaces 51.66 grains per inch.

Turn belt off .460 Weatherby Magnum or .378 Weatherby Magnum brass. Anneal neck, shoulder, and upper body. Form and trim in RCBS form and trim dies. Ream inside neck, in RCBS neck-ream die. Deburr.

.500 Weatherby Magnum

(designer's specs)

solid:
1,624 gr brass
190 gr water

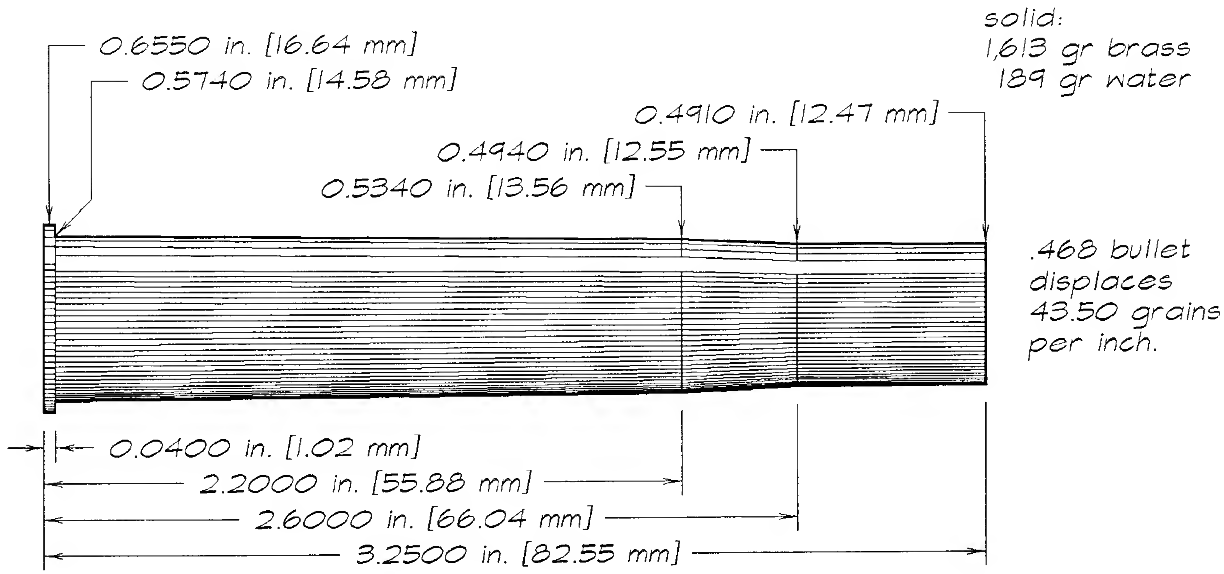


.512 bullet displaces 52.07 grains per inch.

Fire-form .460 Weatherby brass with inert filler.

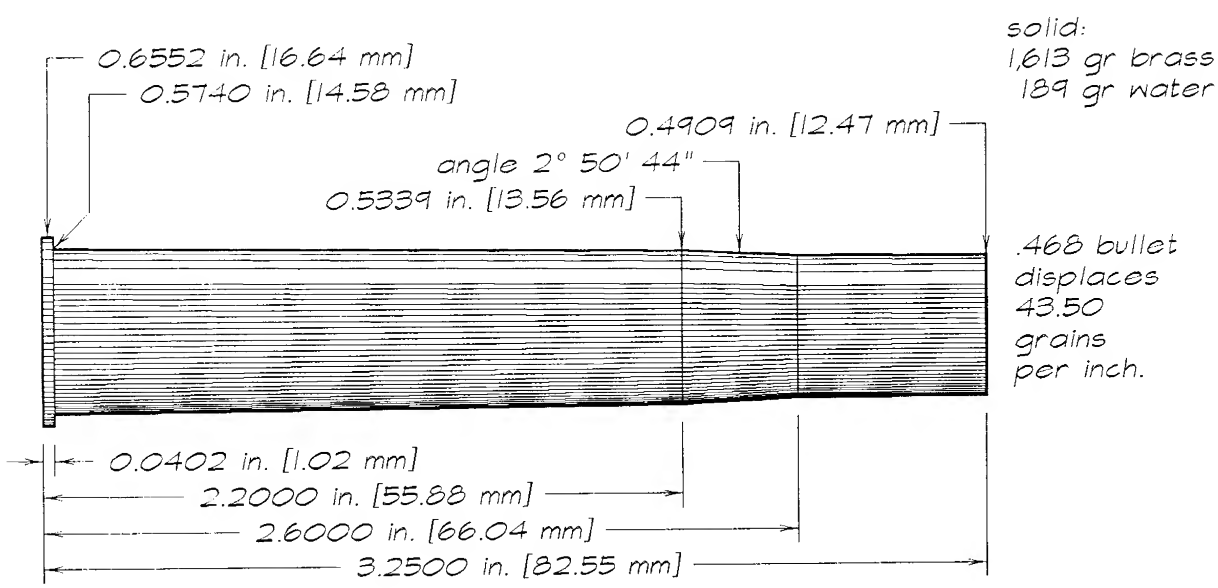
Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.500-.465 Nitro Express (Birmingham Proof House)



Use factory .500-.465 NE brass. Or form from .500 NE 3¼-Inch or .500 NE Basic brass, in the respective set of RCBS form dies.

.500-.465 Nitro Express (CIP maximums)

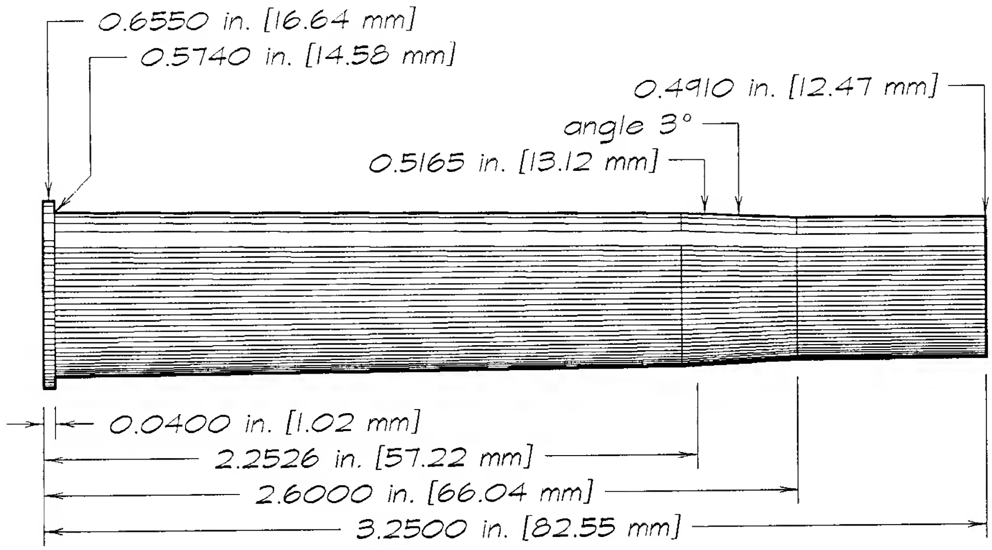


Use factory .500-.465 NE brass. Or form from .500 NE 3¼-Inch or .500 NE Basic brass, in respective RCBS form dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.500-.450 Nitro Express (ICI Metals Ltd dwg)

solid:
1,613 gr brass
189 gr water

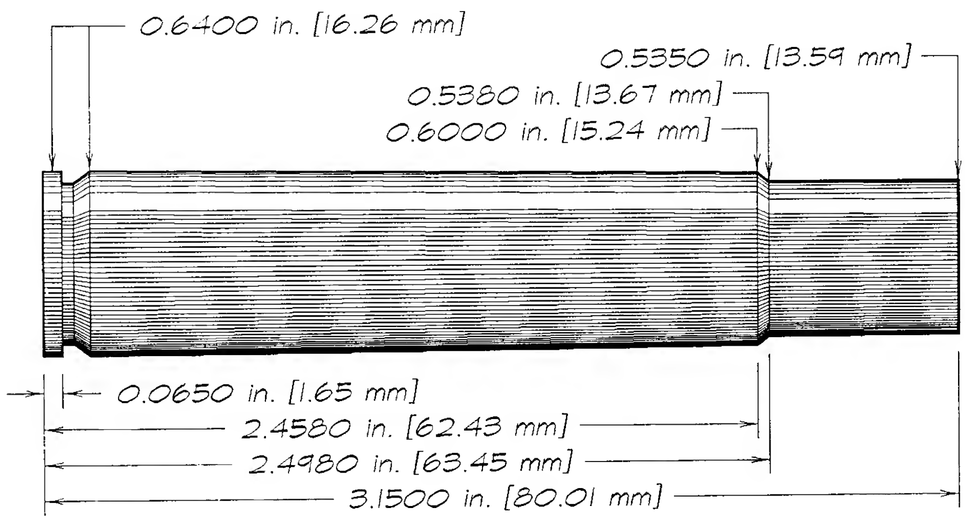


.468 bullet displaces 43.50 grains per inch.

Use factory .500-.465 NE brass. Or form from .500 NE 3¼-Inch or .500 NE Basic brass, in respective RCBS form dies.

.505 Magnum (Gibbs) (Birmingham Proof House)

solid:
1,938 gr brass
227 gr water



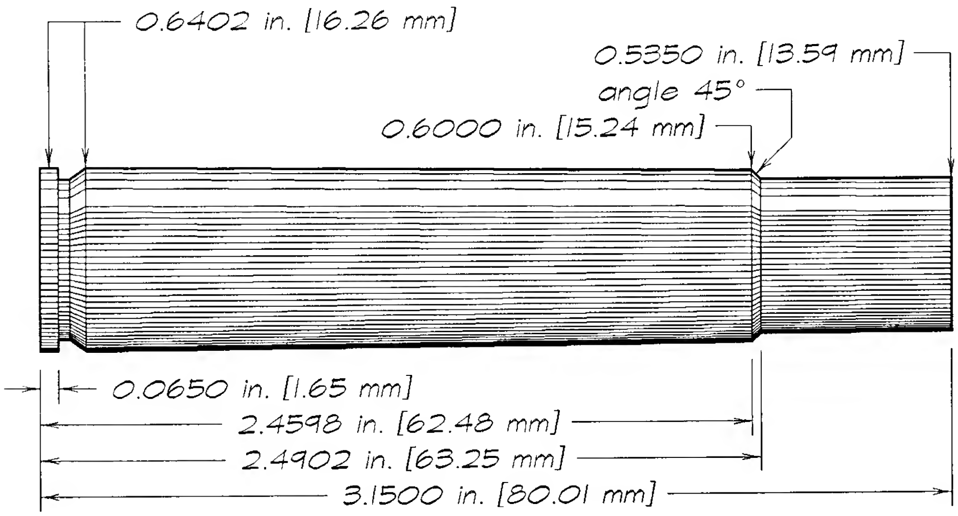
.505 bullet displaces 50.65 grains per inch.

Use factory .505 Gibbs brass. Or form from .505 Gibbs Basic brass, in RCBS form die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.505 Magnum Gibbs (CIP maximums)

solid:
1,938 gr brass
227 gr water

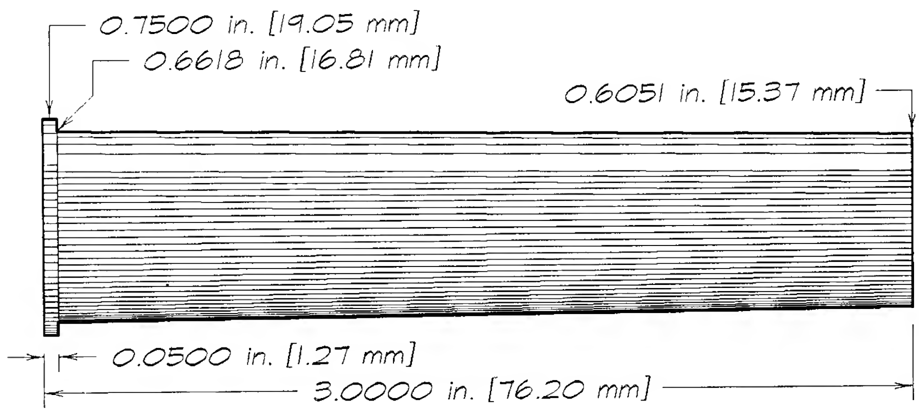


.505 bullet displaces 50.65 grains per inch.

Use recently manufactured .505 Gibbs brass. Or form from .505 Gibbs Basic brass, in RCBS form die.

.577 Nitro Express 3-Inch (CIP maximums)

solid:
2,061 gr brass
242 gr water



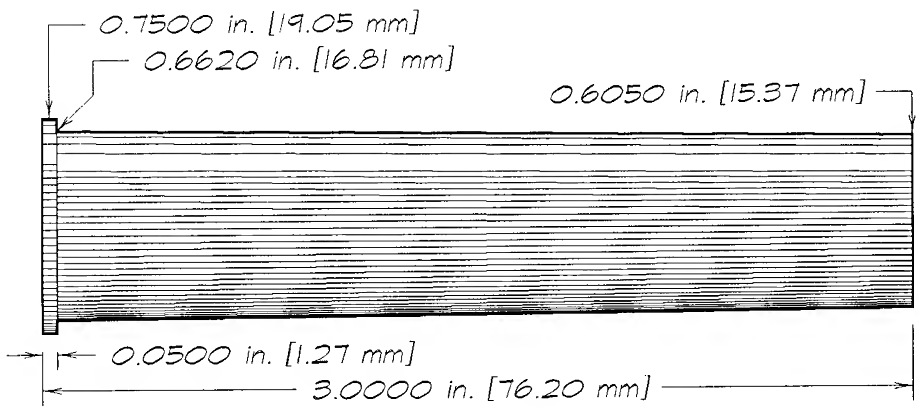
.584 bullet displaces 67.74 grains per inch.

Use recently manufactured .577 NE 3-Inch or 3¼-Inch brass.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.577 Nitro Express 3-Inch (ICI Metals Ltd dwg)

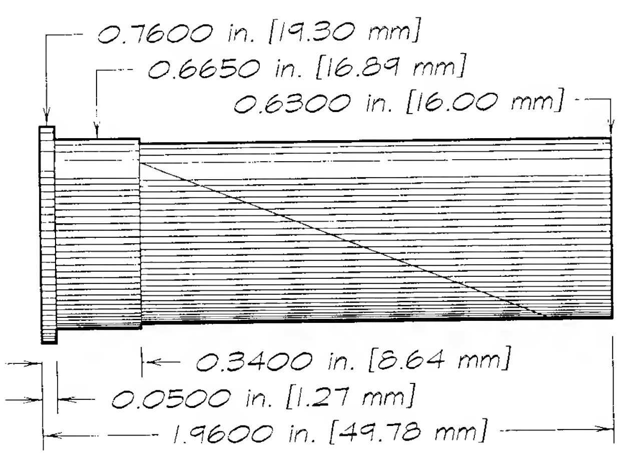
solid:
2,062 gr brass
242 gr water



.584 bullet displaces 67.74 grains per inch.

Use factory .577 NE 3-Inch brass. Or form from .577 3¼-inch Basic brass.

.577 Snider (Kynoch drawing, 1884)



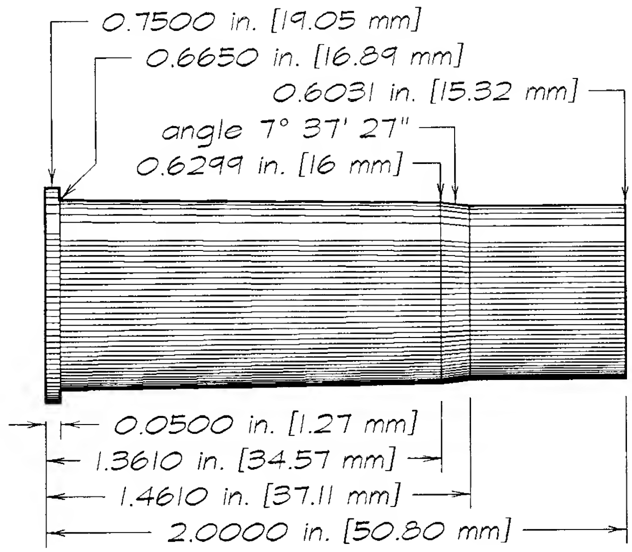
The body of this old case was originally cardboard, later brass -- coiled like the core of a toilet-paper roll. There's no satisfactory way to do this yourself.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.577 Solid Snider

(CIP maximums)

solid:
1,395 gr brass
164 gr water



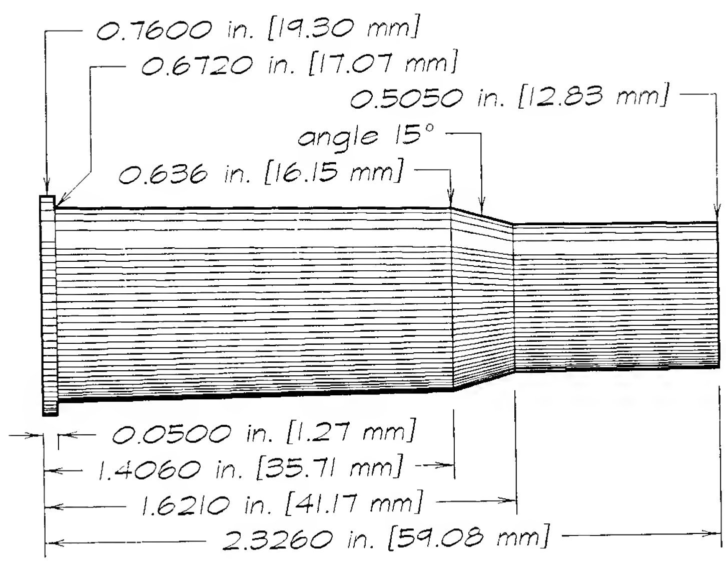
.574 bullet displaces
65.44 grains per inch.

Use factory "solid" (not rolled foil) .577 Snider brass. Or form from .577 Kynoch or .577 Basic brass, in RCBS form-and-trim die.

.577-.450 Martini Henry

(ICI Metals Ltd dwg)

solid:
1,424 gr brass
167 gr water

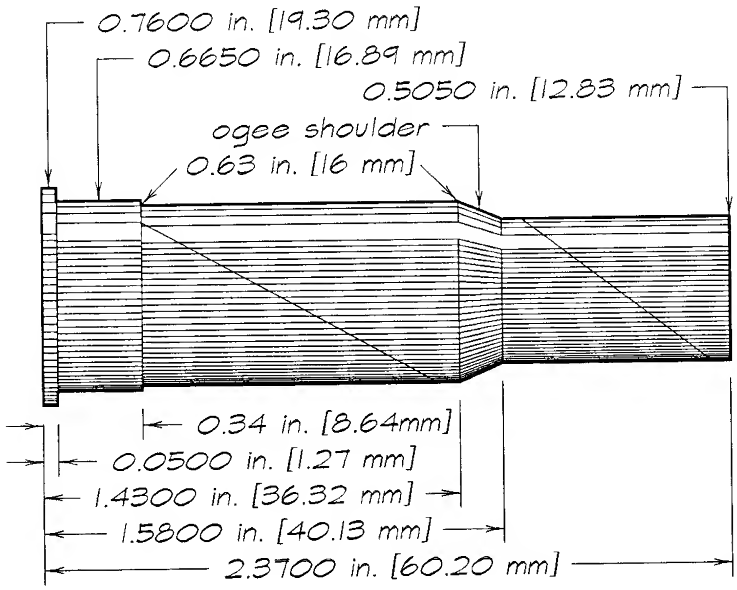


.465 bullet displaces
42.95 grains per inch.

Use factory "solid" (not rolled foil) .577-.450 MH brass. Or form and trim .577 Basic brass in RCBS form dies. Ream inside neck, in RCBS neck-ream die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

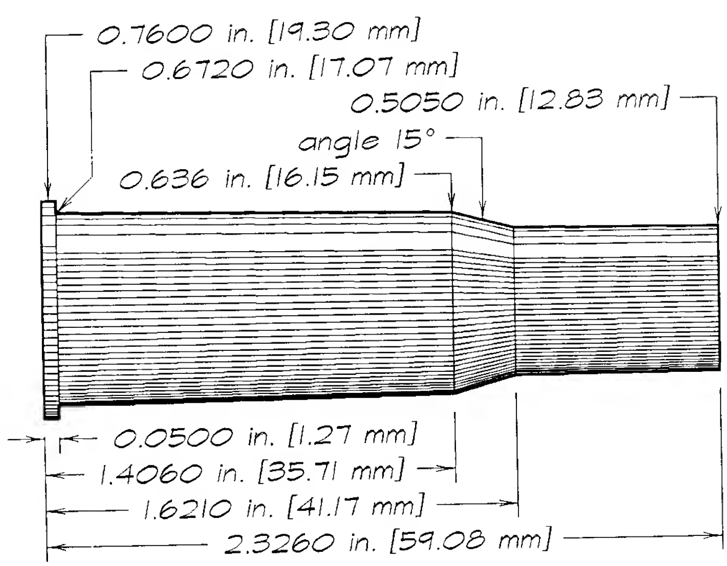
.577-.450 Martini-Henry (English gov't pattern) (Kynoch drawing, 1884)



There's no way to duplicate this old two-piece case, made with a roll of brass coiled like the core of a toilet-paper roll and stuffed into a brass base.

.577-.450 Solid Martini Henry (ICI Metals Ltd dwg)

solid:
1,424 gr brass
167 gr water



.465 bullet displaces 42.95 grains per inch.

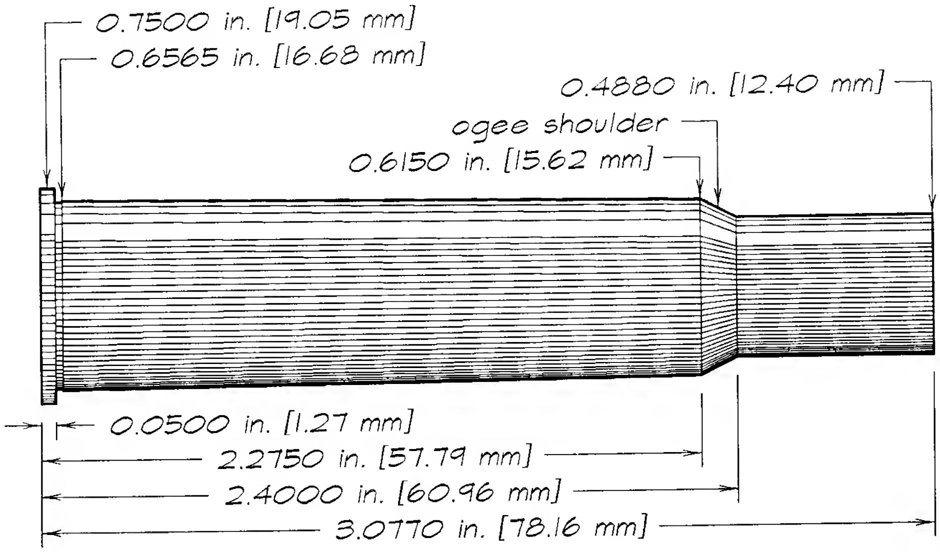
Use factory "solid" (not rolled foil) .577-.450 MH brass. Or form and trim .577 Basic brass in RCBS form and trim dies, then ream inside neck in neck-ream die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.577-.450 Super Express

(unfired specimen)

solid:
1,893 gr brass
222 gr water



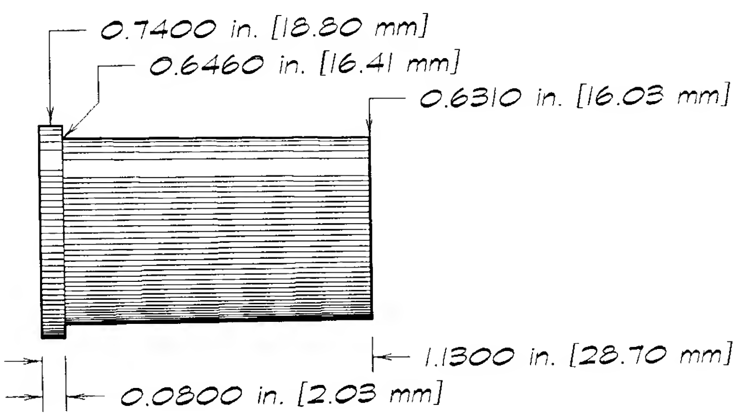
.458 bullet displaces 41.66 grains per inch.

Use recently manufactured .577-.450 SE brass. Or anneal forward portion of recently manufactured .577 3-inch Basic brass, then form and trim in RCBS form and trim dies.

.58 Carbine

(Winchester drawing, 1913)

solid:
813 gr brass
95 gr water



.605 bullet displaces 72.70 grains per inch.

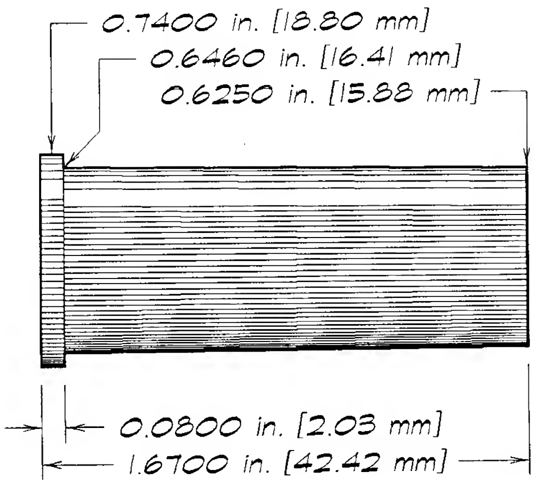
Form from .577 Nitro Express Basic brass, in RCBS form dies. Protect head of case from heat when annealing body.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.58 Musket

(Winchester drawing, 1912)

solid:
1,167 gr brass
137 gr water



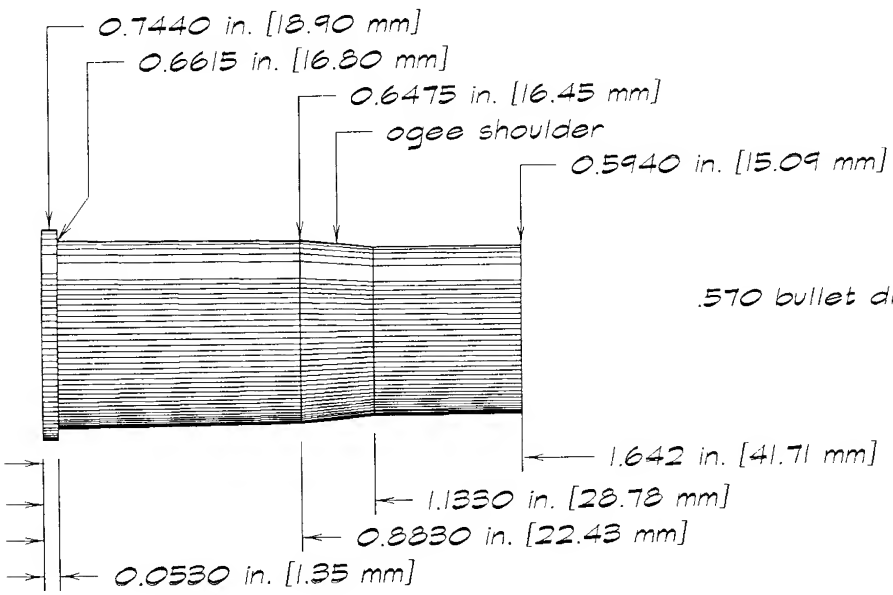
.605 bullet displaces 72.70 grains per inch.

Form from .577 Nitro Express Basic brass, in RCBS form dies.

.58 Snider

(Winchester drawing, 1912)

solid:
1,163 gr brass
136 gr water

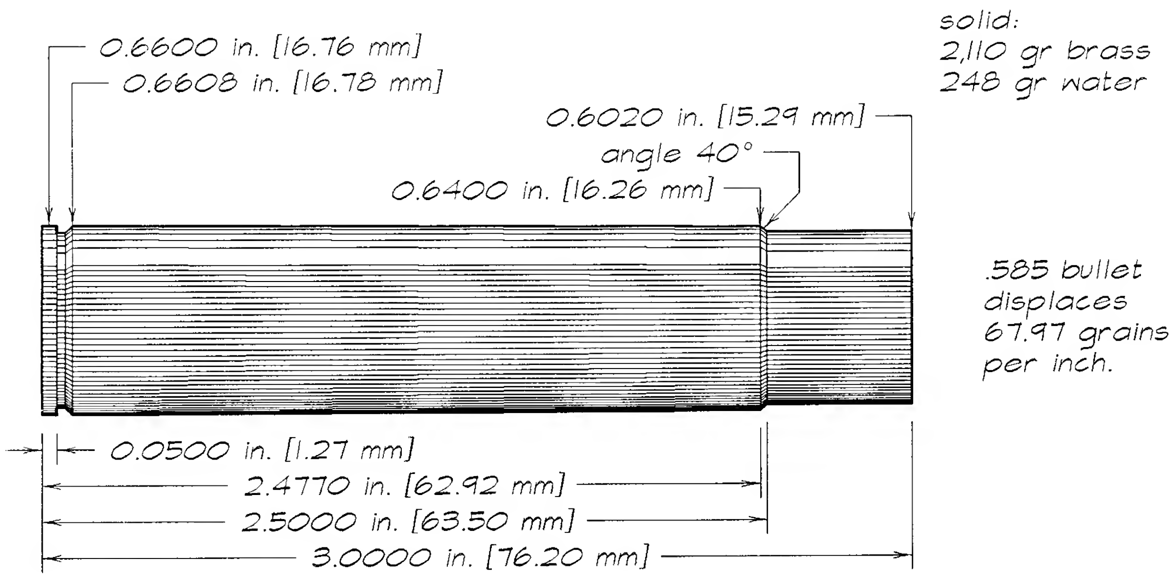


.570 bullet displaces 64.53 gr/in.

Make from .577 Nitro Express. Anneal, with care not to soften head area; trim to length; chamfer mouth.

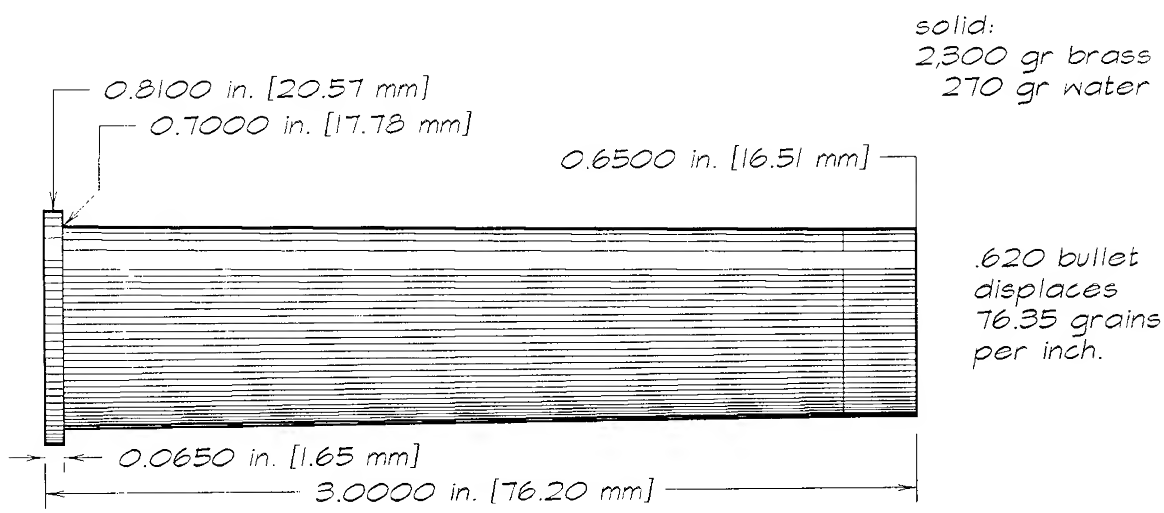
Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.585 Van Horn Express (designer's specs)



Turn rim off .577 Nitro Express brass and cut extractor groove. Form in RCBS form die.

.600 Express (ICI Metals Ltd dwg)



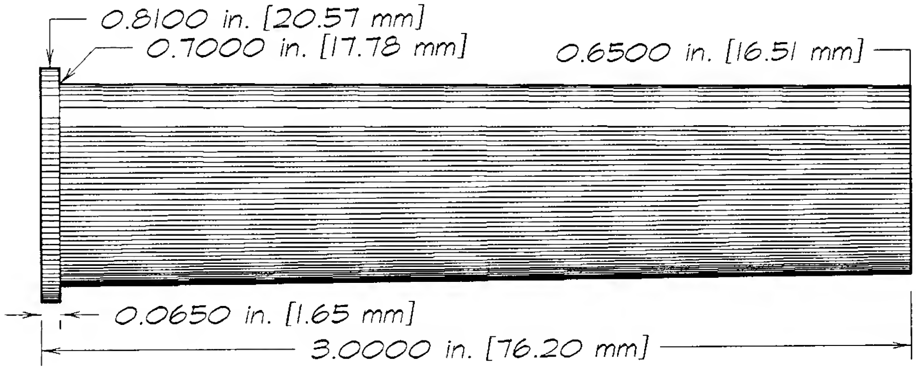
Use recently manufactured .600 Nitro Express brass.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.600 Jeffery

(Kynoch drawing, 1899)

solid:
2,309 gr brass
271 gr water



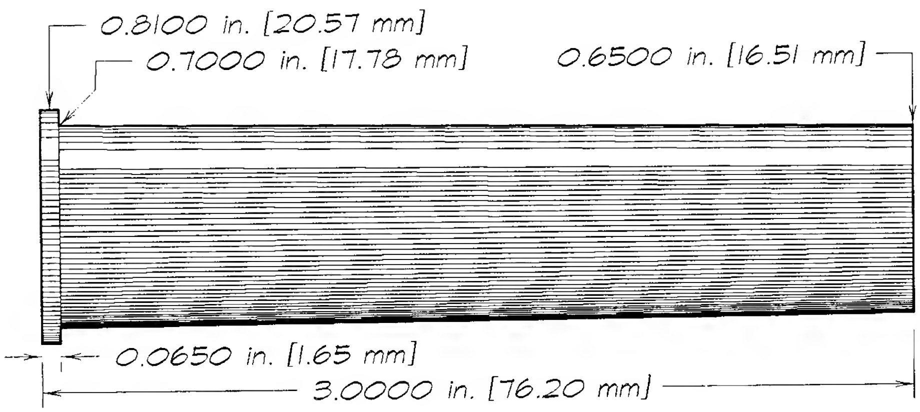
.620 bullet displaces 76.35 grains per inch.

Use recently manufactured factory 600 NE brass.

.600 Nitro Express

(Birmingham Proof House)

solid:
2,309 gr brass
271 gr water

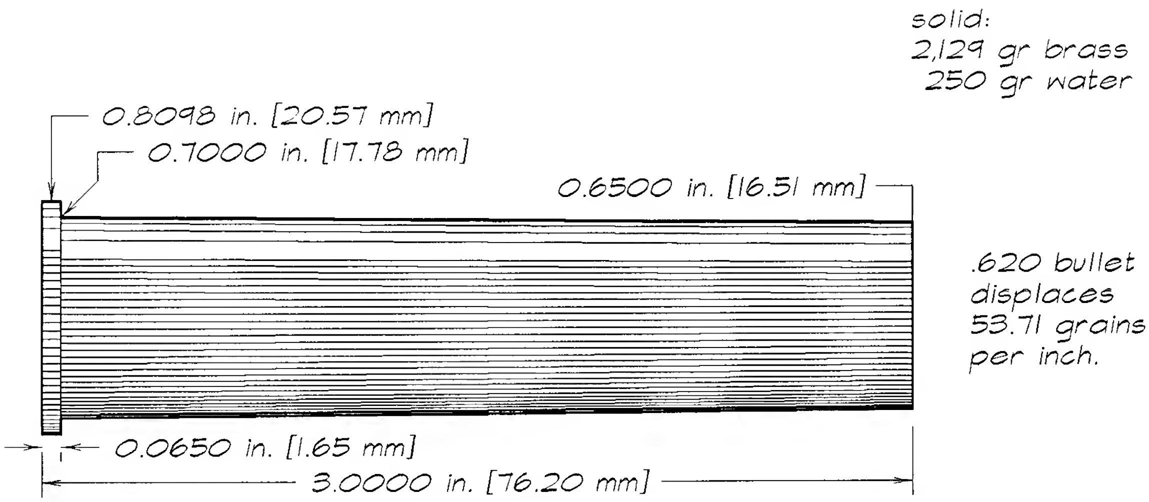


.620 bullet displaces 76.35 grains per inch.

Use recently manufactured .600 NE brass.

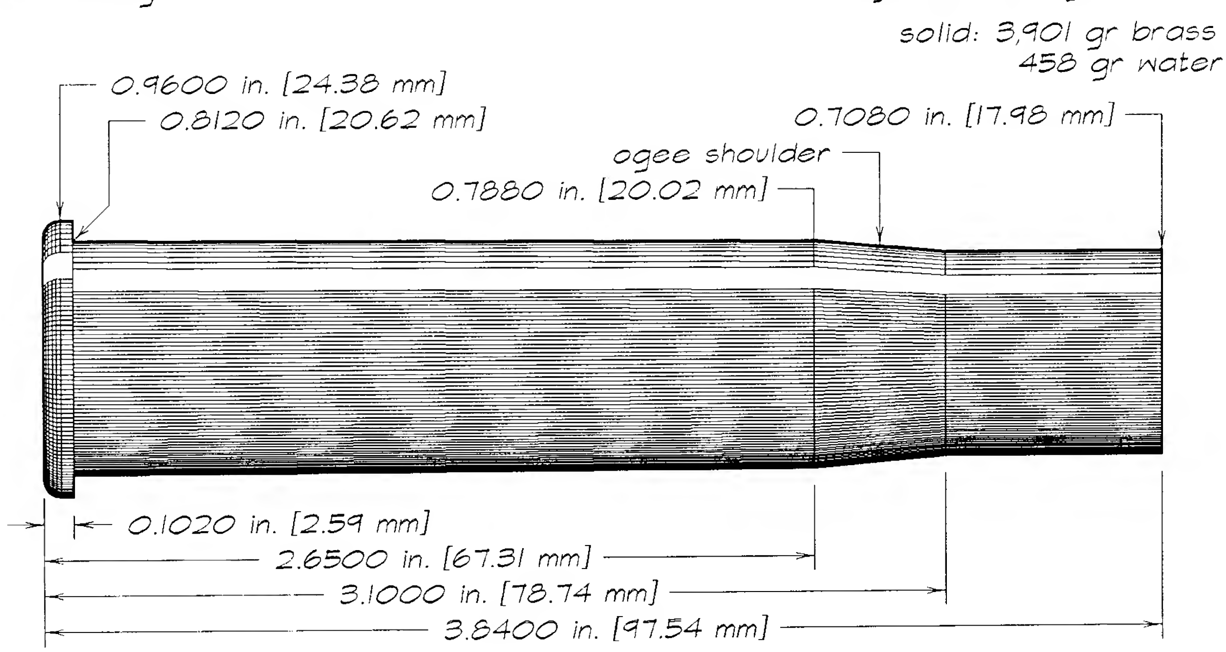
Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.600 Nitro Express (CIP maximums)



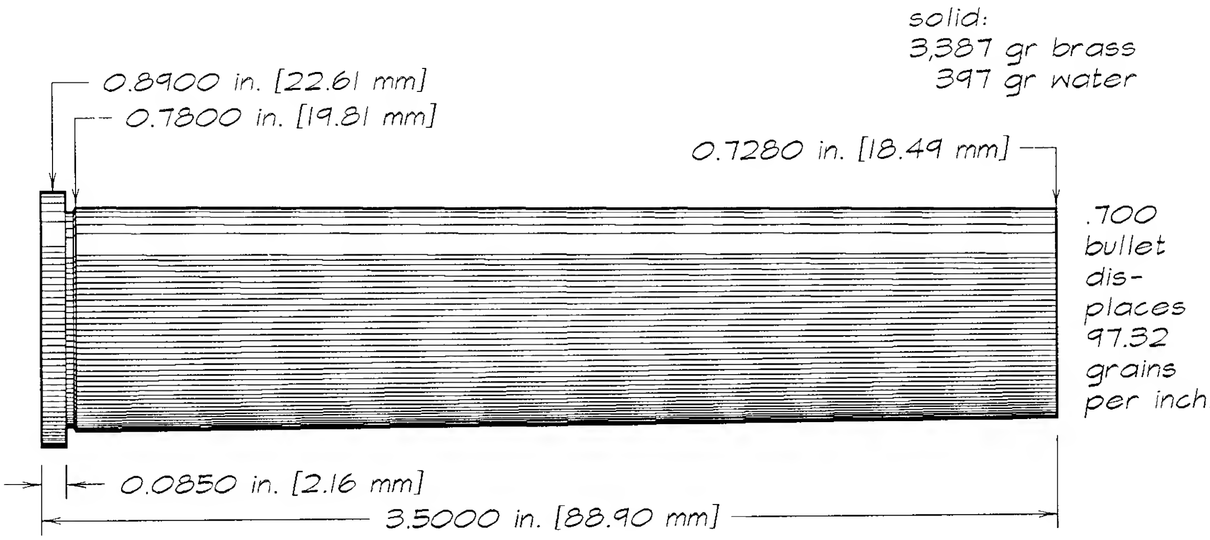
Use recently manufactured .600 NE brass.

.650 Gatling (Kynoch drawing, 1884)



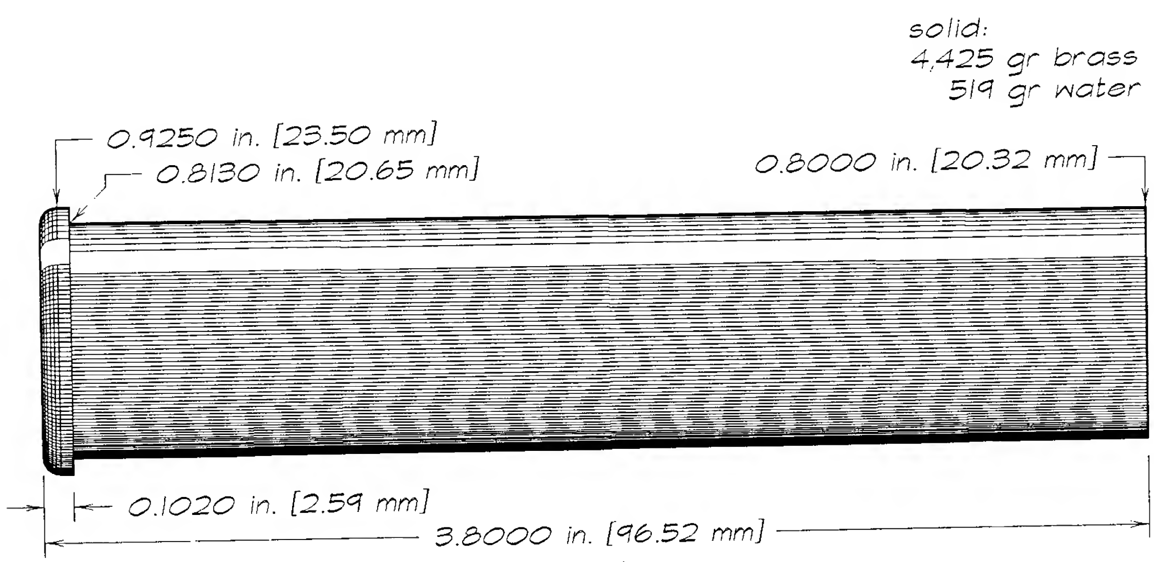
Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.700 Nitro Express (designer's drawing)



Use only factory .700 NE brass. There's no substitute.

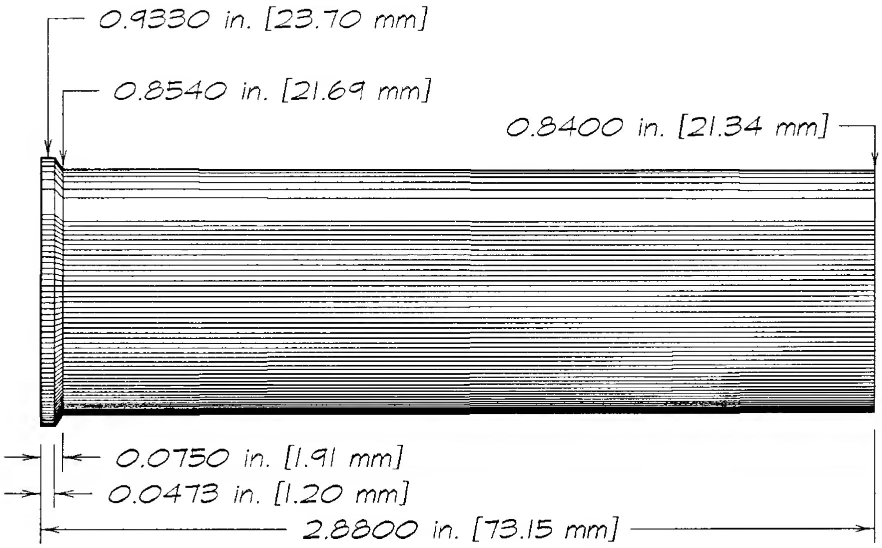
.750 Gatling (Kynoch drawing, 1884)



Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

.775 Express Rigby (specimen, SAAMI)

solid:
3,761 gr brass
441 gr water

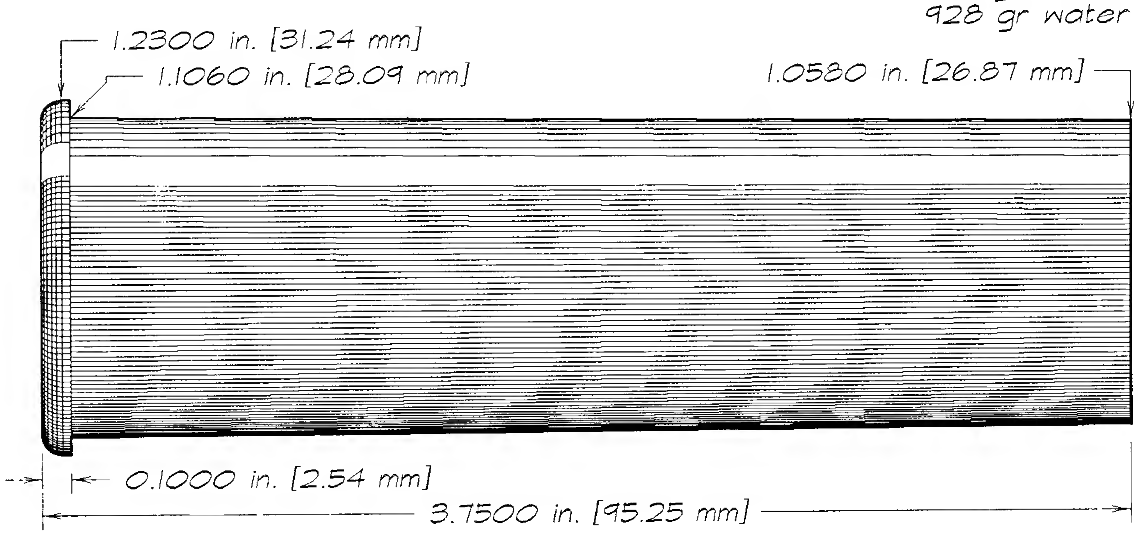


.775 bullet displaces 119.29 grains per inch.

This is one of a special kind, a 2⅞-inch 10-gauge brass CARTRIDGE CASE. So the only case to use is an original factory Rigby case.

1-inch Gatling (Kynoch drawing, 1884)

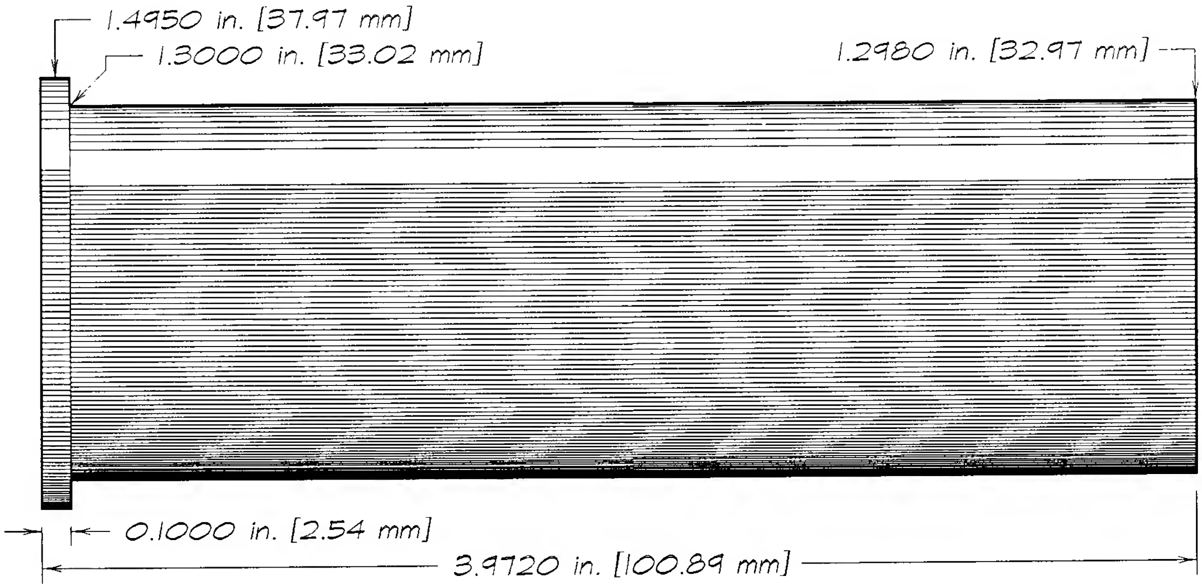
solid:
7,915 gr brass
928 gr water



I don't know of any other cartridge you can make from this one, or into this one. I include it just for historical or hysterical interest.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

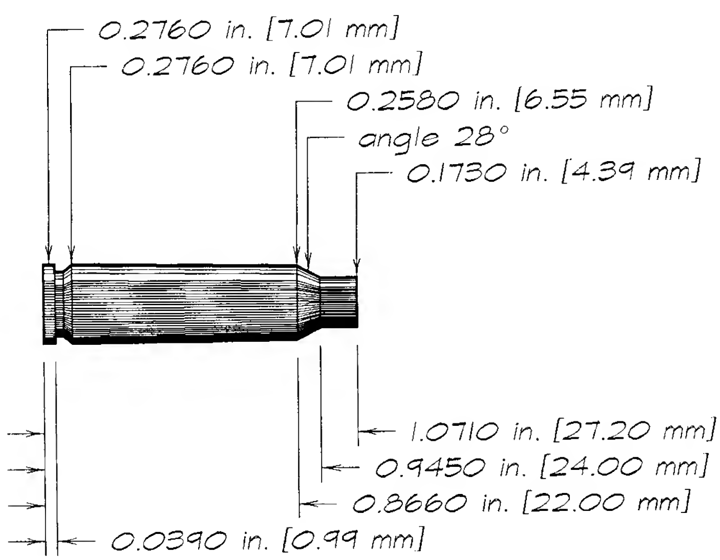
1.25 Barker-Butler Bear Thumper (Barker specimen)



No cases are available. I include this special-purpose cartridge just to show how far someone went to produce a custom cartridge. Barker made the guns and the ammo; Butler used them to discourage Canadian polar (and other) bears from hanging around humans. Its soft 900-grain plastic bullet really thumped 'em.

4x27mm CETME (Cartucheria Española)

solid:
117 gr brass
14 gr water



.163 bullet displaces
5.28 grains per inch.

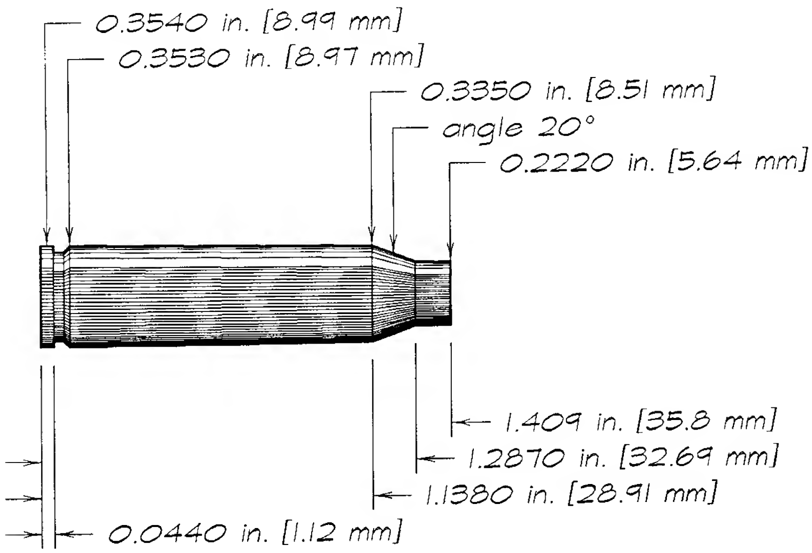
Most likely the only brass for this little experimental cartridge is some of the original CETME brass, which "was never produced in large quantities." Sure is a cute little thing, isn't it? I'd love to have two for the tips of a bolo tie.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

4.56x36mm CETME-HK

(Cartucheria Española)

solid:
258 gr brass
30 gr water

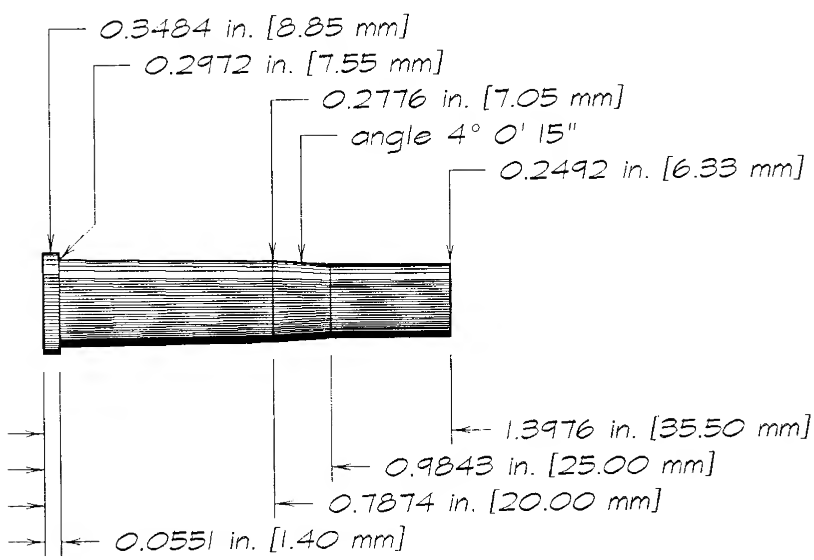


.185 bullet displaces
6.8 grains per inch.

5.6x35mm Rimmed

(CIP maximums)

solid:
182 gr brass
21 gr water



.222 bullet displaces
9.79 grains per inch.

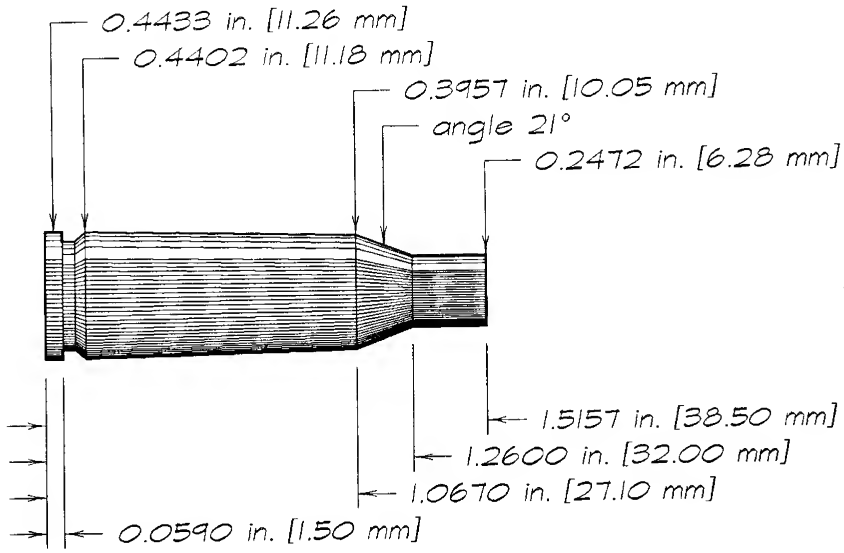
Use factory 5.6x35mm Rimmed brass. Or form from .22 Hornet brass, in RCBS form dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

5.6x39mm

(Triebel maximums)

solid:
384 gr brass
45 gr water



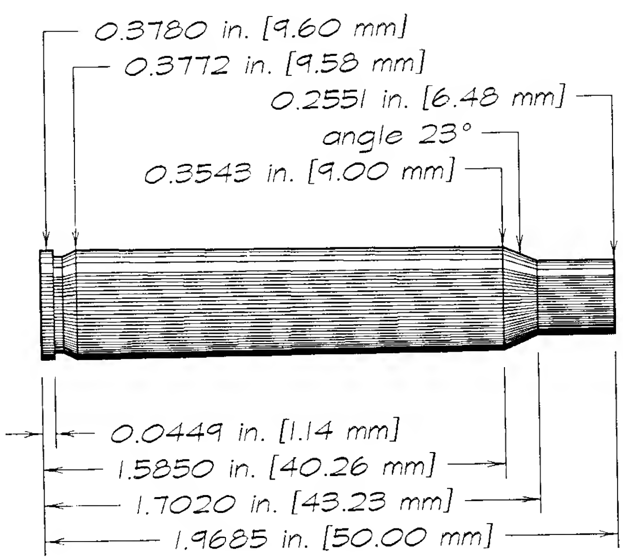
.221 bullet displaces
9.70 grains per inch.

Anneal neck and shoulder of .220 Swift brass. Form and trim in RCBS form-and-trim die. Ream inside neck, in RCBS neck-ream die.

5.6x50mm Magnum

(CIP maximums)

solid:
405 gr brass
47 gr water



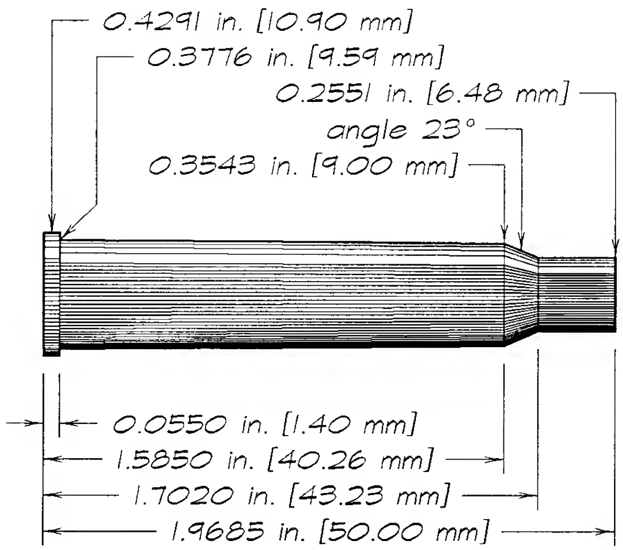
.224 bullet displaces
9.97 grains per inch.

Use factory 5.6x50mm Magnum brass. No satisfactory substitute exists. (.222 Remington brass is too short.)

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

5.6x50mm Rimmed Magnum (CIP maximums)

solid:
408 gr brass
48 gr water

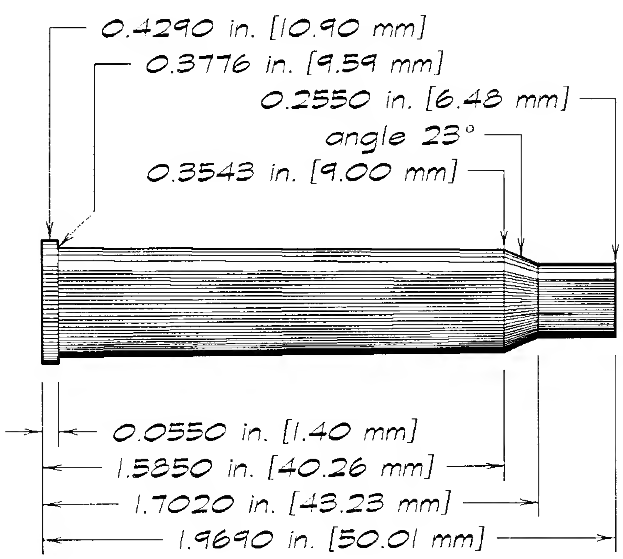


.224 bullet displaces
9.97 grains per inch.

Use factory 5.6x50mm Rimmed Magnum brass. No satisfactory substitute exists.

5.6x50mm Rimmed Magnum (RCBS drawing)

solid:
409 gr brass
48 gr water



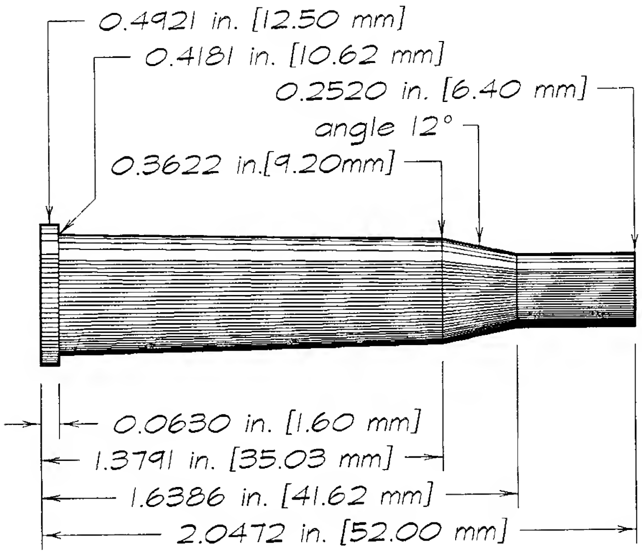
.224 bullet displaces
9.97 grains per inch.

No substitute available. Use RWS factory 5.6x50mm R Magnum brass.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

5.6x52mm Rimmed

(CIP maximums)



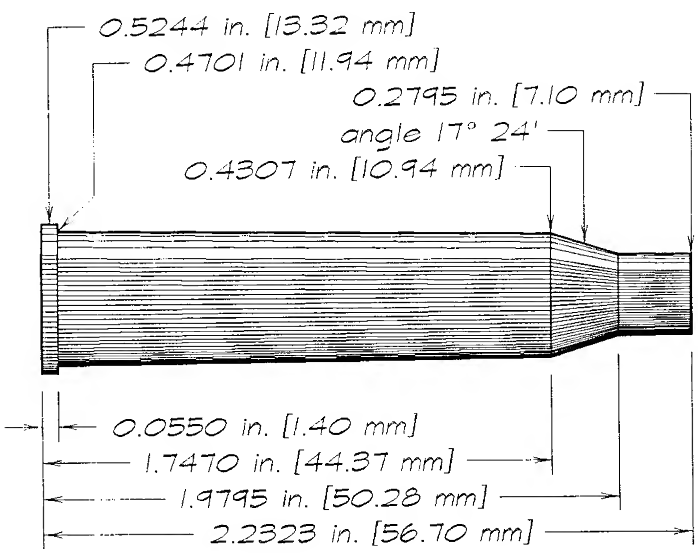
solid:
448 gr brass
53 gr water

.228 bullet displaces
10.32 grains per inch.

Use recently manufactured 5.6x52R or the essentially similar .22 Savage brass. Or anneal neck and shoulder of .30-30 or .38-55 Winchester brass, then form in RCBS form dies.

5.6x57mm Rimmed

(CIP maximums)



solid:
701 gr brass
82 gr water

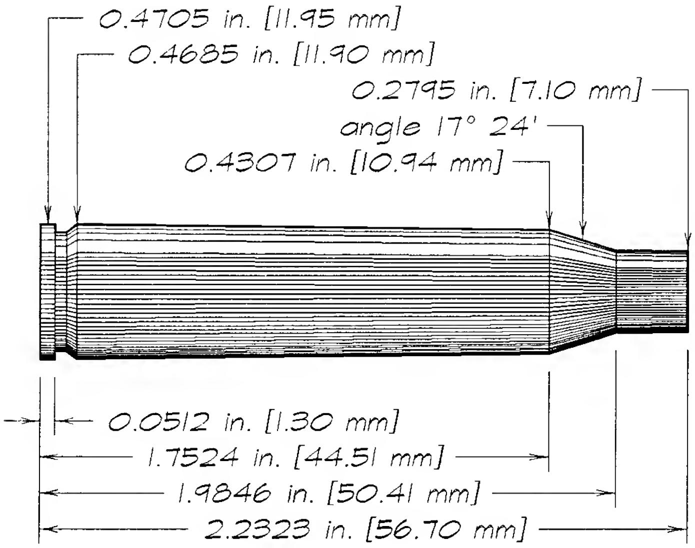
.224 bullet displaces
9.97 grains per inch.

Use factory 5.6x57mm Rimmed brass. Or anneal upper body of .444 Marlin brass, then form and trim in RCBS form and trim dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

5.6x57mm RWS (CIP maximums)

solid:
694 gr brass
81 gr water

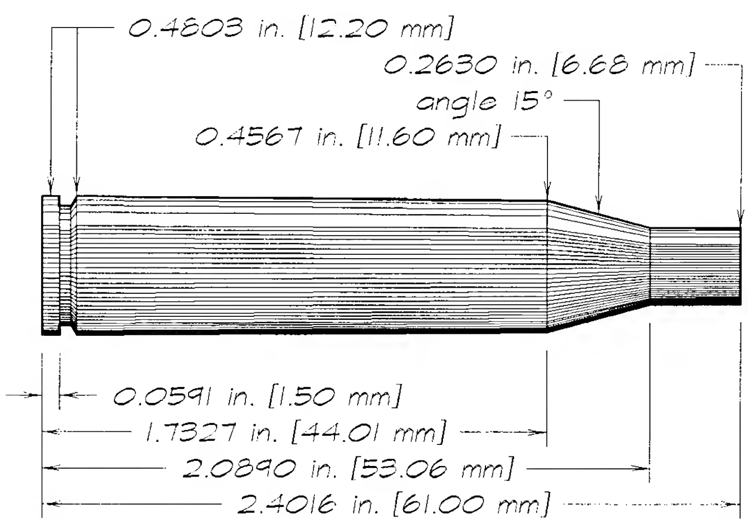


.224 bullet displaces
9.97 grains per inch.

Use factory 5.6x57mm RWS brass. Or form from 7x57mm Mauser brass, in RCBS form die and load in special RCBS sizer die.

5.6x61mm Super Express vom Hofe (CIP maximums)

solid:
759 gr brass
89 gr water



.227 bullet displaces
10.23 grains per inch.

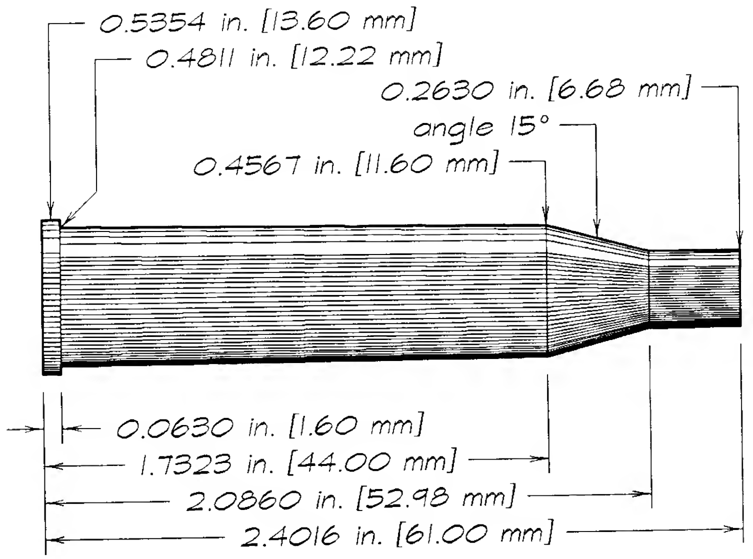
Use factory 5.6x61mm SE vH brass. Or form from .30-06 Springfield brass, in RCBS form dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

5.6x61mm Rimmed Super Express vom Hofe

(CIP maximums)

solid:
796 gr brass
93 gr water



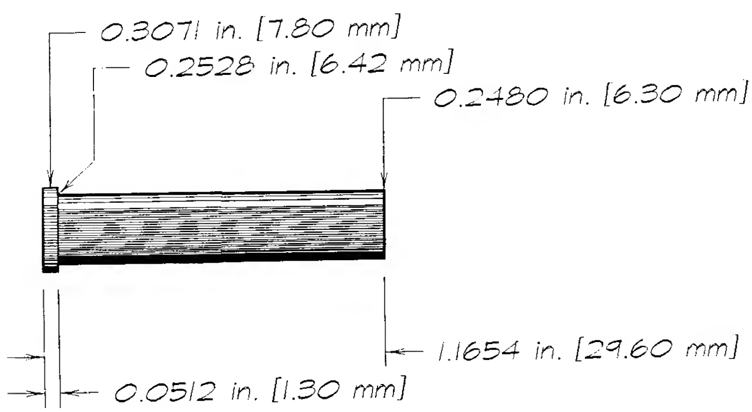
.227 bullet displaces
10.23 grains per inch.

Use recently manufactured 5.6x61mm Rimmed SE vH brass.

5.75mm Velodog

(CIP maximums)

solid:
127 gr brass
15 gr water



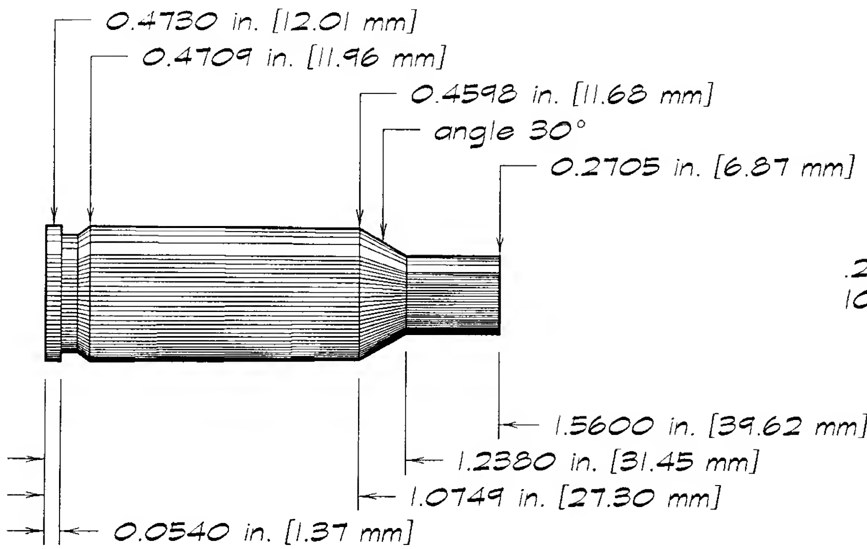
.228 bullet displaces
10.32 grains per inch.

Use factory 5.75mm Velodog brass. Or use .22 Cooper Centerfire Magnum brass, which is virtually identical to the Velodog.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

6mm Bench Rest Remington (6mm BR) (SAAMI maximums)

solid:
463 gr brass
54 gr water

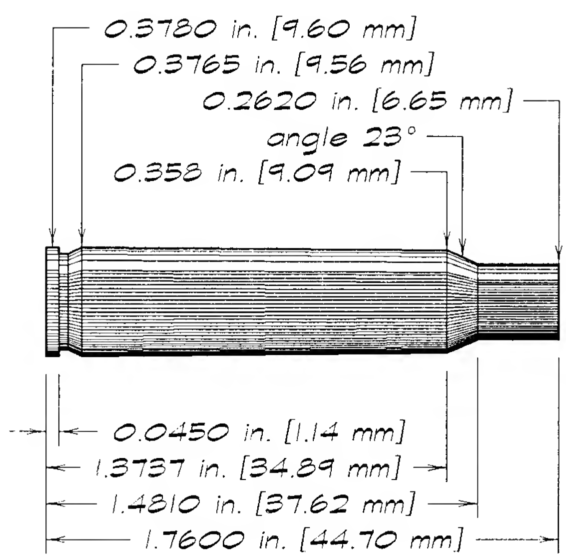


.243 bullet displaces
10.88 grains per inch.

Form from Remington BR case, 7mm Bench Rest Remington case, or .308 Winchester case, in respective RCBS form dies.

6mm Cheap Shot (designer's specs)

solid:
364 gr brass
43 gr water



.243 bullet displaces
11.73 grains per inch.

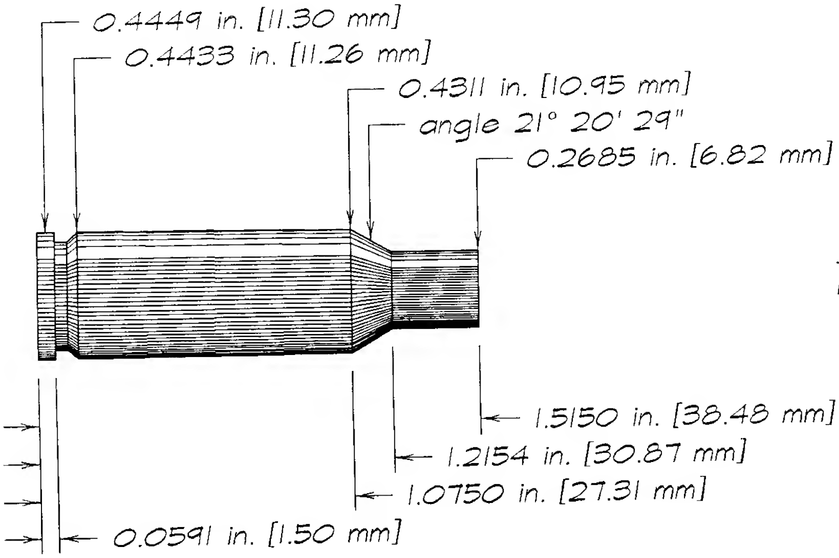
Resize .222 Remington Magnum brass full-length in body of 6mm CS sizer die. Fire-form with inert filler. Trim to length. Deburr.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

6mm PPC (FI version)

(CIP maximums)

solid:
406 gr brass
48 gr water



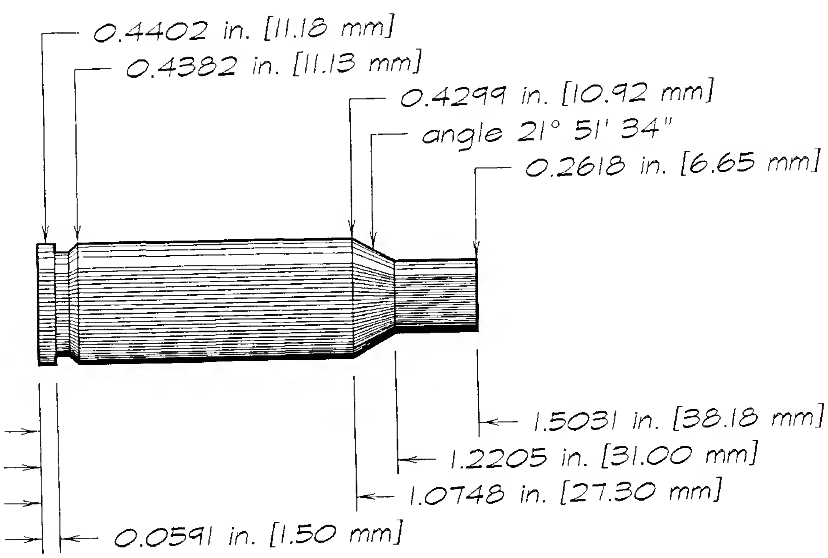
.243 bullet displaces
11.73 grains per inch.

Form from .220 Russian or 7.62x39mm brass, in RCBS form-and-trim die.

6mm PPC (US version)

(CIP maximums)

solid:
398 gr brass
47 gr water



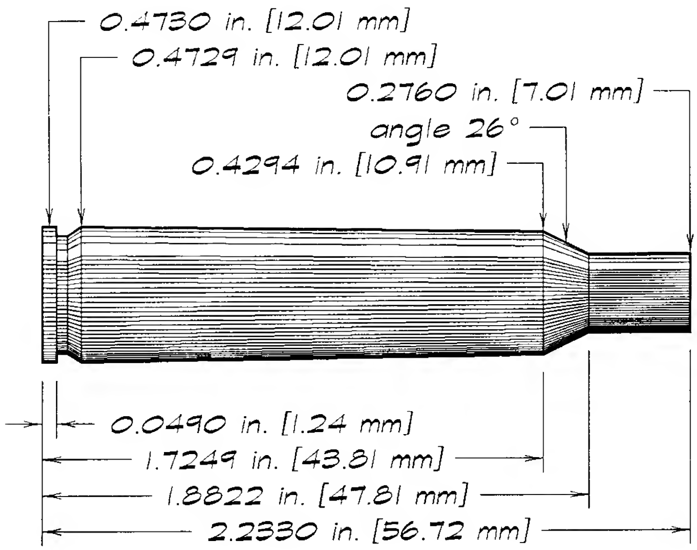
.243 bullet displaces
11.73 grains per inch.

Form from .220 Russian or 7.62x39mm brass, in RCBS form-and-trim dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

6mm Remington

(SAAMI maximums)



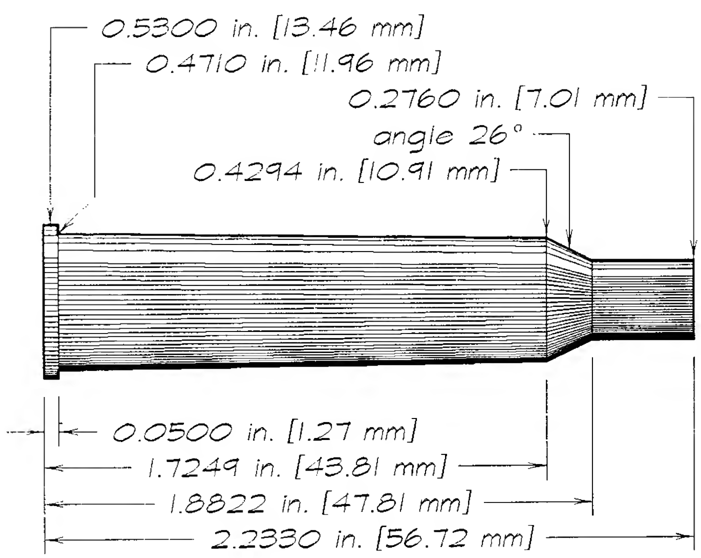
solid:
683 gr brass
80 gr water

.243 bullet displaces
11.73 grains per inch.

Recently made factory brass should be plentiful and easy to find. If necessary, form from .257 Roberts brass, in RCBS form, trim, and ream dies.

6mm Remington Rimmed

(designer's specs)



solid:
676 gr brass
79 gr water

.243 bullet displaces
11.73 grains per inch.

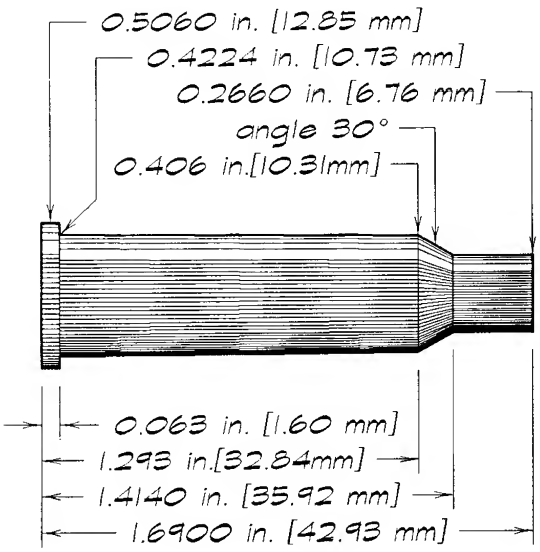
Anneal shoulder and upper body of .307 Winchester brass. Form in RCBS form die. Ream inside neck if necessary, in RCBS neck-ream die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

6mm SM Wasp

(David J LeGate)

solid:
435 gr brass
51 gr water



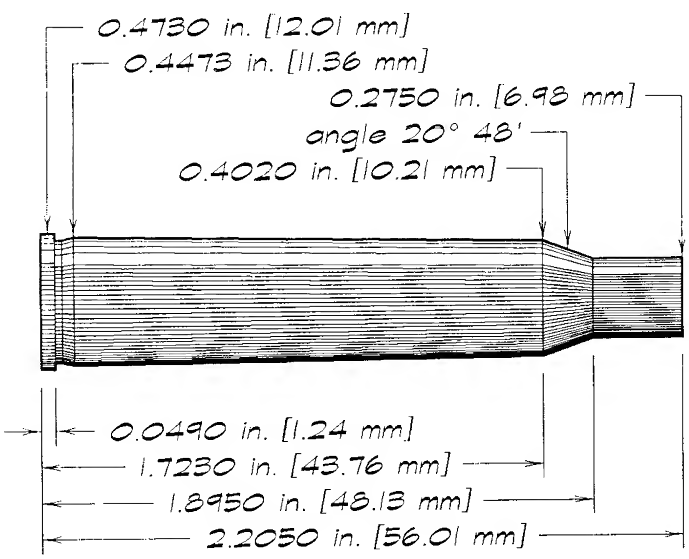
.243 bullet displaces
11.73 grains per inch.

Shorten .30-30 Winchester or Federal .30 American brass to 1.70 inches. Form in RCBS .219 Wasp form dies. Deburr mouths. Resize full-length in 6mm SM Wasp sizer die. Trim length to 1.69 inches. Deburr. Turn necks to 0.011 inch thick. Fire-form with inert filler.

6mm Swift

(David J LeGate)

solid:
628 gr brass
74 gr water



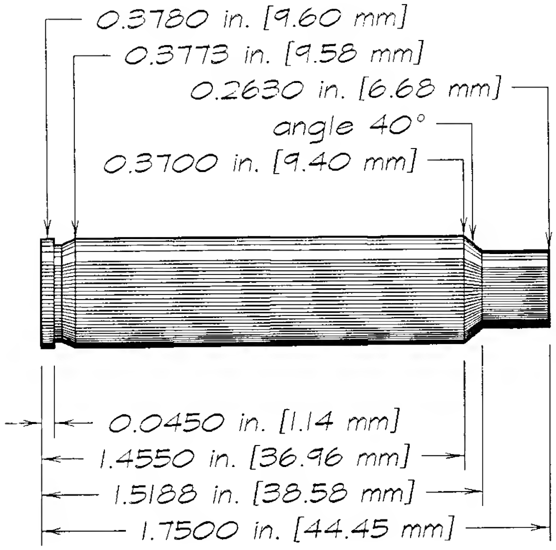
.243 bullet displaces
11.73 grains per inch.

Anneal neck and shoulder of .220 Swift brass and fire-form with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

6mm T/CU

(unidentified drawing)



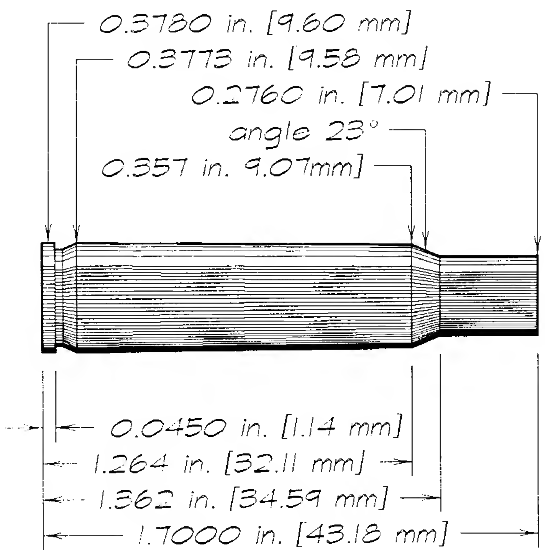
solid:
378 gr brass
44 gr water

.243 bullet displaces
11.73 grains per inch.

Fire-form .223 Remington brass with inert filler. Or resize .222 Remington Magnum brass full-length in 6mm T/CU sizer die, trim to length, deburr, and fire-form with inert filler.

6mm-.222

(David J LeGate)



solid:
351 gr brass
41 gr water

.2435 bullet displaces
11.78 grains per inch.

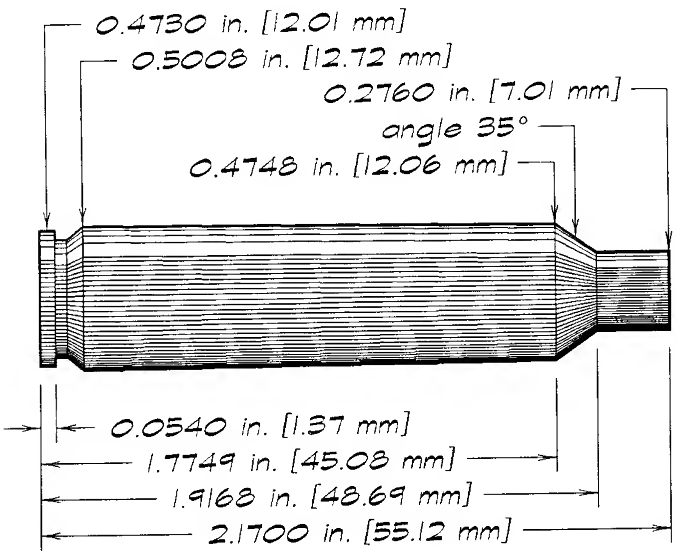
Fire-form .222 Remington brass with inert filler. Or anneal neck and shoulder of .223 Remington or .222 Remington Magnum brass, trim to 1.7 inches, resize full-length in 6mm-.222 sizer die, and fire-form with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

6mm-.284 Winchester

(designer's specs)

solid:
716 gr brass
84 gr water



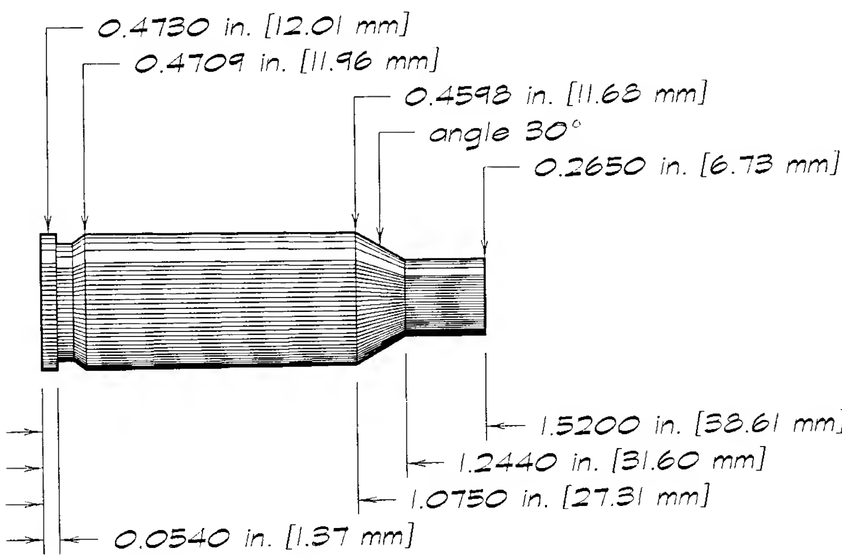
.243 bullet displaces
11.73 grains per inch.

Form from .284 Winchester brass, in RCBS form-and-trim die.

6mm-.308 Remington

(Remington drawing, 1976)

solid:
423 gr brass
50 gr water



.243 bullet displaces
11.73 grains per inch.

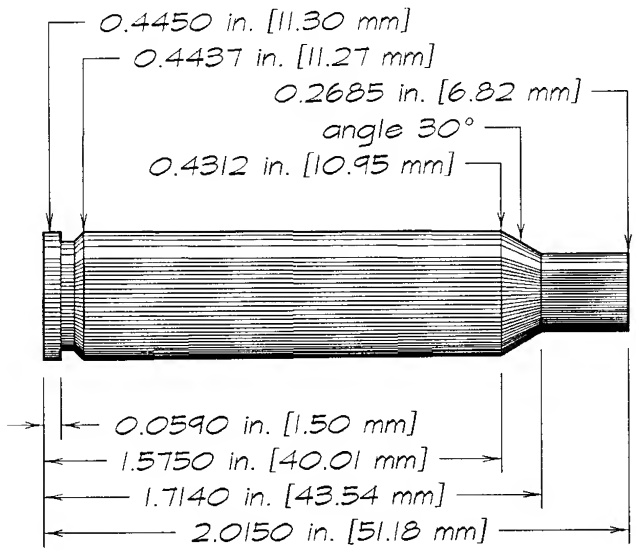
Anneal shoulder and upper body of .243 Winchester brass. Trim to 1.52 inch and resize full-length in 6mm-.308 sizer die. Trim to 1.52 inch and deburr.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

6mm 2-Inch PPC

(WCD Jr drawing)

solid:
567 gr brass
67 gr water

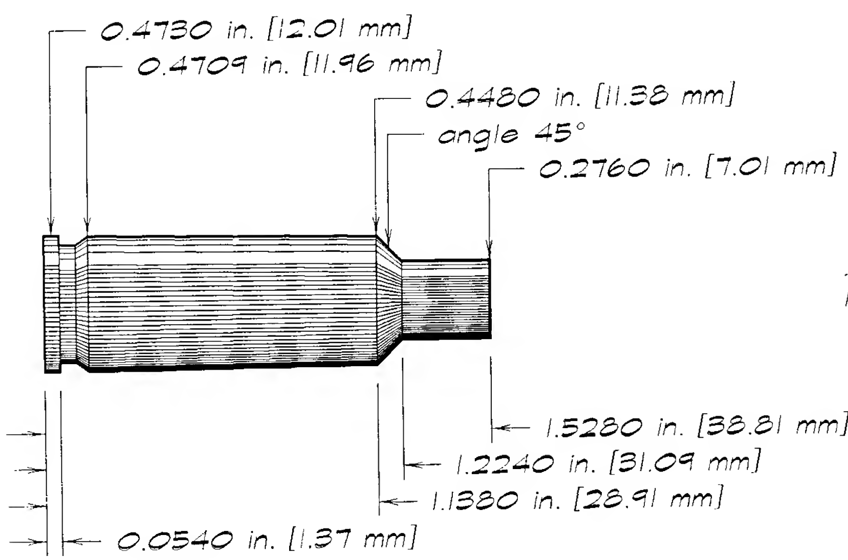


.243 bullet displaces
11.73 grains per inch.

6x39mm (6mm-.308 Short)

(David J LeGate)

solid:
462 gr brass
54 gr water



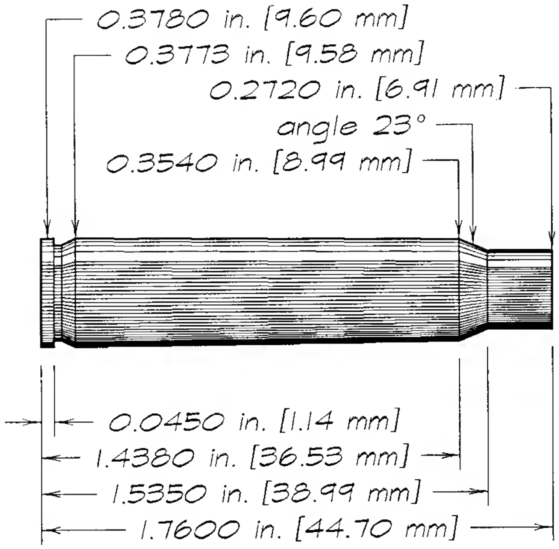
.243 bullet displaces
11.73 grains per inch.

Anneal neck and shoulder of .308 Winchester brass. Form and trim in RCBS form-and-trim die. Ream inside neck with RCBS neck-ream set.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

6x45mm (6mm-.223)

(David J LeGate)



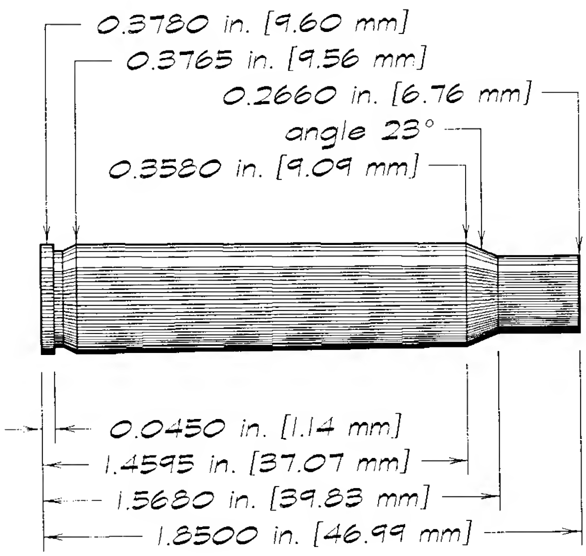
solid:
374 gr brass
44 gr water

.243 bullet displaces
11.73 grains per inch.

Fire-form .223 Remington brass with inert filler, then resize full-length, trim to 1.76 inches, and deburr.

6x47mm

(David J LeGate)



solid:
387 gr brass
45 gr water

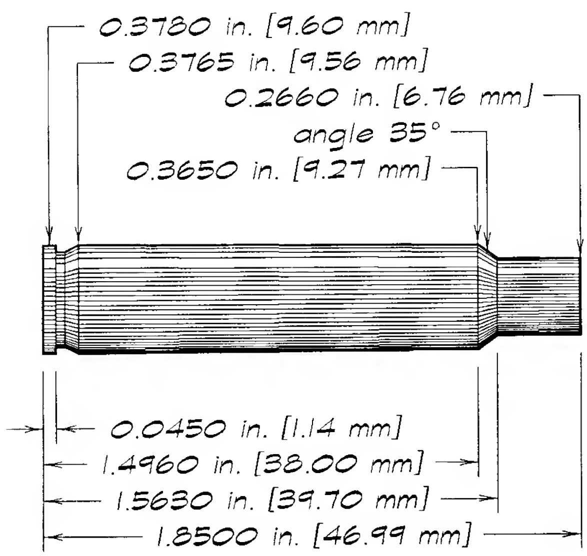
.243 bullet displaces
11.73 grains per inch.

Fire-form .222 Remington Magnum brass with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

6x47mm Improved 35°

(David J LeGate)



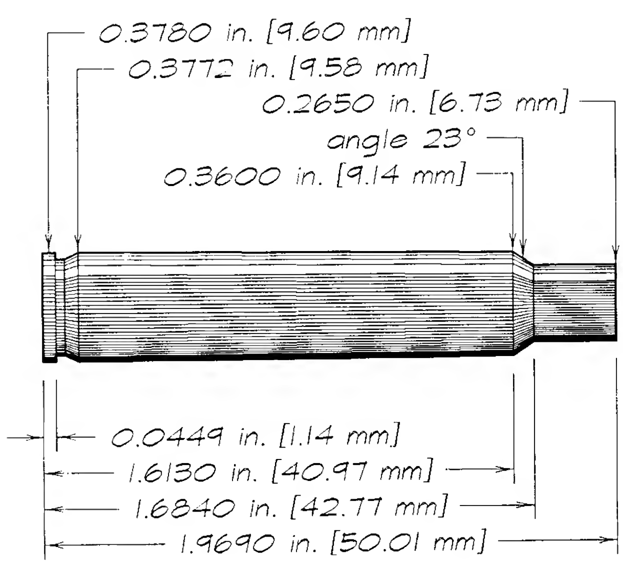
solid:
392 gr brass
46 gr water

.243 bullet displaces
11.73 grains per inch.

Fire-form .222 Remington Magnum brass with inert filler.

6x50mm S&H

(David J LeGate)



solid:
415 gr brass
49 gr water

.243 bullet displaces
11.73 grains per inch.

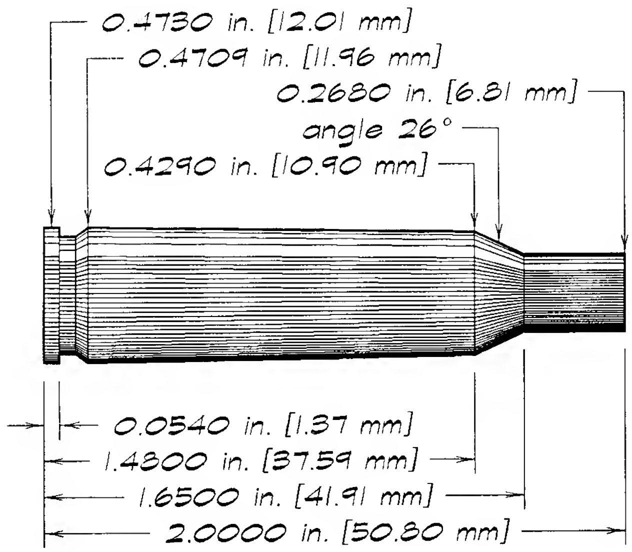
Fire-form 5.6x50mm Magnum brass with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

6x51mm Belk & Shanks

(designer's specs)

solid:
594 gr brass
70 gr water



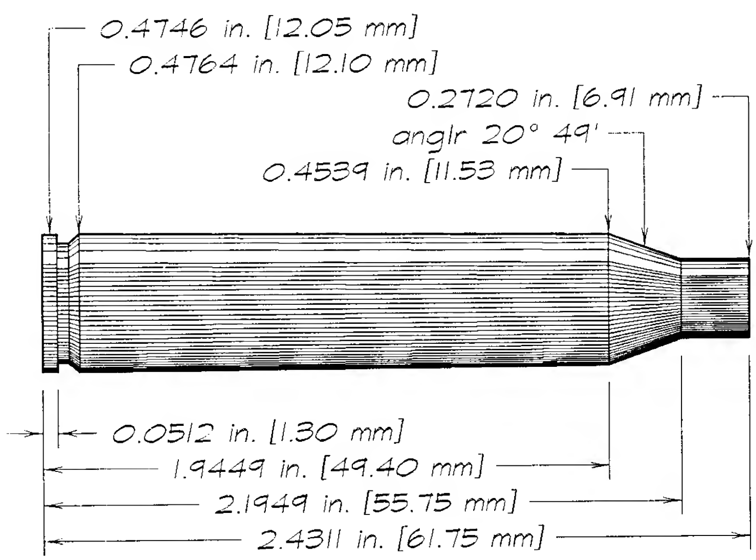
.243 bullet displaces
11.73 grains per inch.

Anneal neck, shoulder, and upper body of .243 Winchester or .308 Winchester brass. Resize full-length in 6x51mm B&S sizer die (6mm Remington die shortened 0.233 inch). Trim to 1.990 inch. Deburr.

6x62mm Freres

(CIP maximums)

solid:
795 gr brass
93 gr water



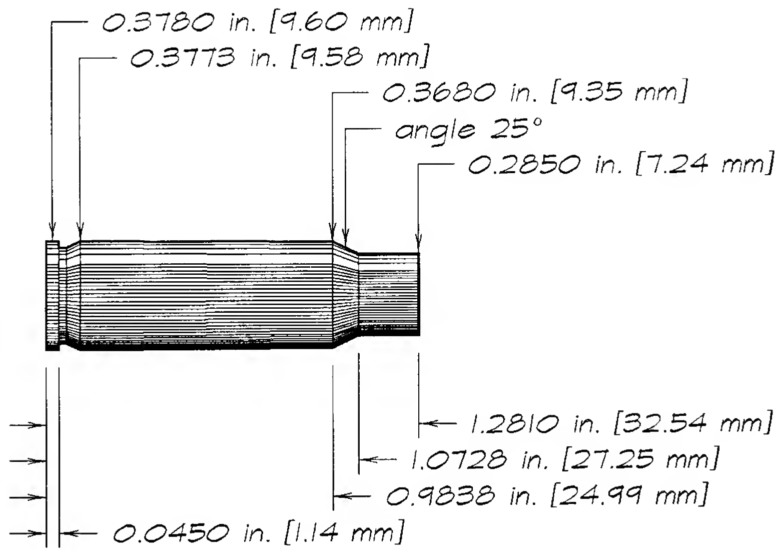
.243 bullet displaces
11.73 grains per inch.

Resize .25-06 Remington brass full-length in 6x62mm sizer die. Trim to 2.43 inches and deburr. Fire-form with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

6.3mm Spitfire

(designer's specs)



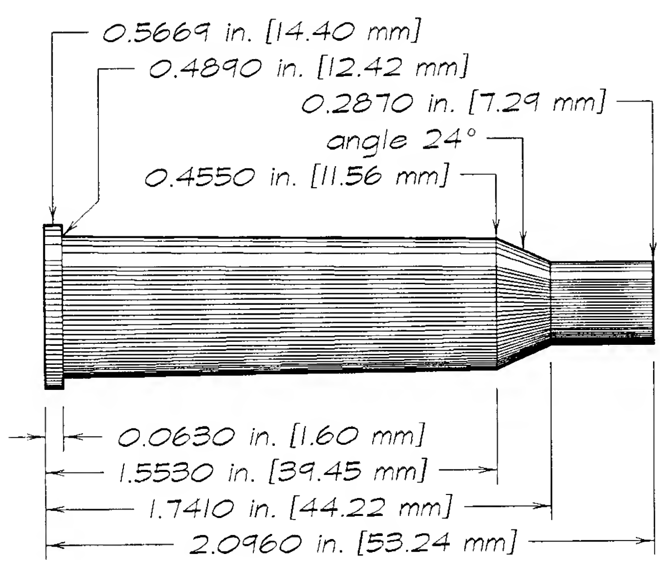
solid:
276 gr brass
32 gr water

.257 bullet displaces
13.12 grains per inch.

Resize .222 or .223 Remington Magnum brass full-length in body of .256 Winchester Magnum sizer die (with decapper-expander removed). Trim to 1.28 inches long. Fire-form with inert filler.

6.3x53mm Rimmed (Finland)

(unfired specimen)



solid:
625 gr brass
73 gr water

.258 bullet displaces
13.22 grains per inch.

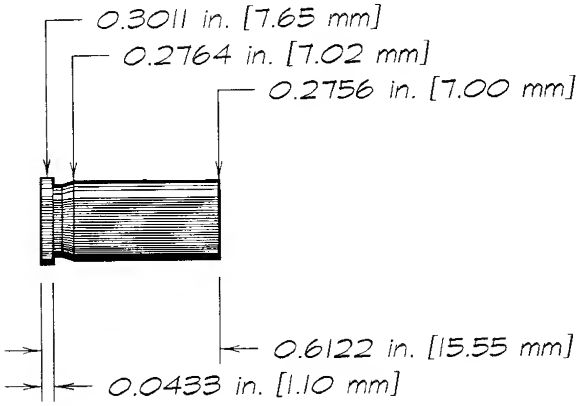
Resize 7.62x53mm R brass, or the virtually identical 7.62x54mm R brass, full-length in 6.3x53mm Rimmed sizer die. Trim and deburr.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

6.35mm Browning

(CIP maximums)

solid:
83 gr brass
10 gr water



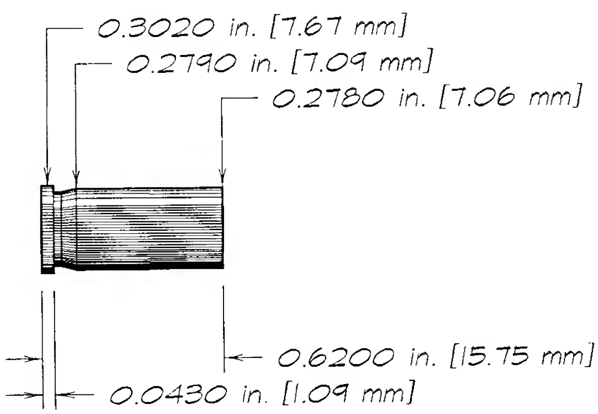
.251 bullet displaces
12.51 grains per inch.

Use factory 6.35mm Browning brass. Or use .25 Automatic (.25 ACP) brass, which is virtually identical.

6.35mm Browning Auto Pistol

(ICI Metals Ltd dwg)

solid:
86 gr brass
10 gr water



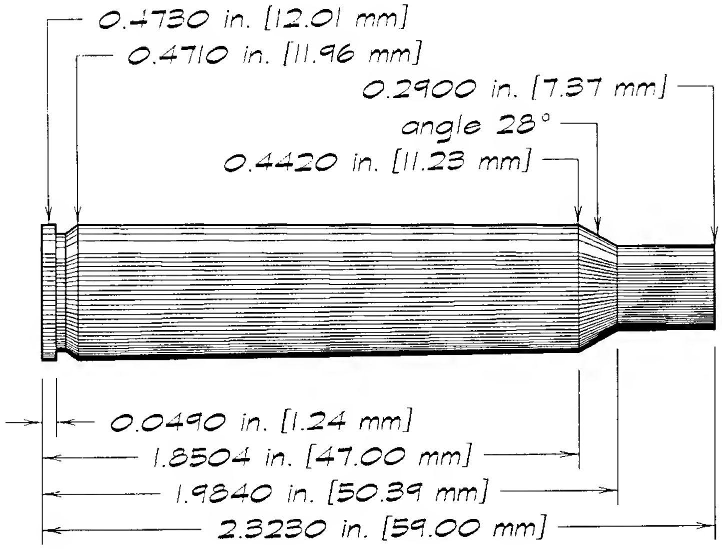
.250 bullet displaces
12.41 grains per inch.

Use factory 6.35mm Browning brass or the essentially identical .25 Automatic (.25 ACP) brass.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

6.35x59mm

(David J LeGate)



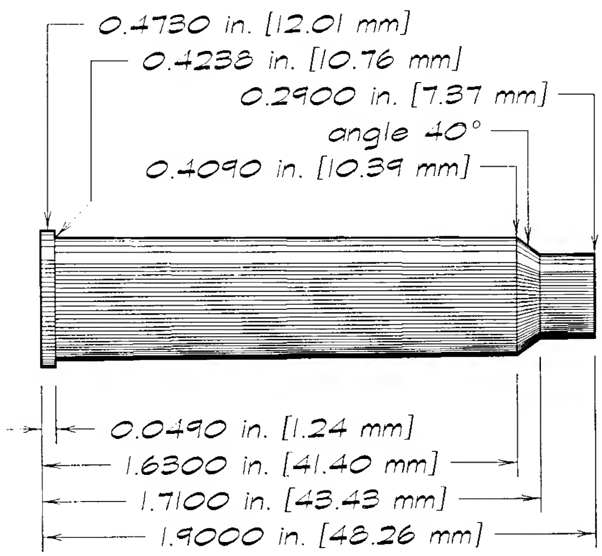
solid:
733 gr brass
86 gr water

.257 bullet displaces
13.12 grains per inch.

Form from .270 Winchester brass, in RCBS form and trim dies.

6.5mm JDJ

(David J LeGate)



solid:
553 gr brass
65 gr water

.264 bullet displaces
13.84 grains per inch.

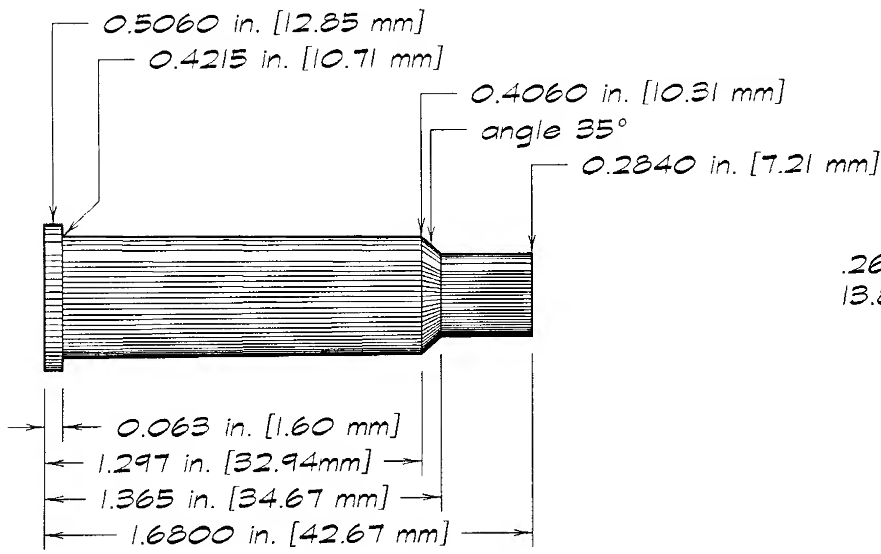
Fire-form .225 Winchester brass with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

6.5mm Jurras

(Jurras drawing)

solid:
439 gr brass
52 gr water



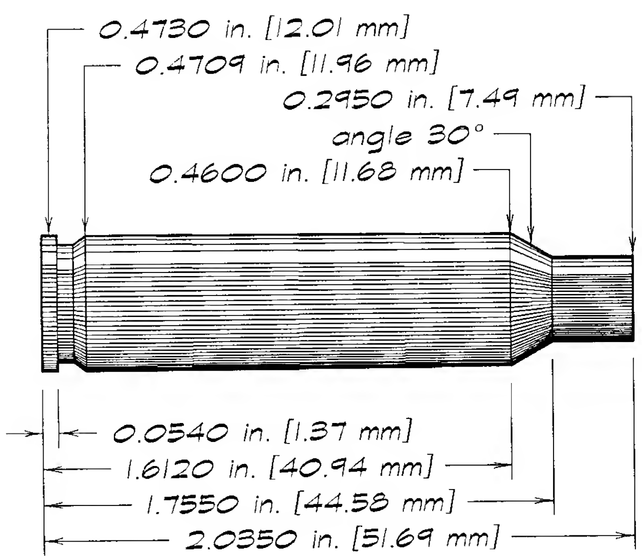
.264 bullet displaces
13.84 grains per inch.

Anneal neck and shoulder of .30-30 Winchester brass. Form and trim in RCBS form-and-trim die. Ream inside neck with RCBS neck-ream set. Fire-form with inert filler.

6.5mm Redding

(unidentified drawing)

solid:
659 gr brass
77 gr water



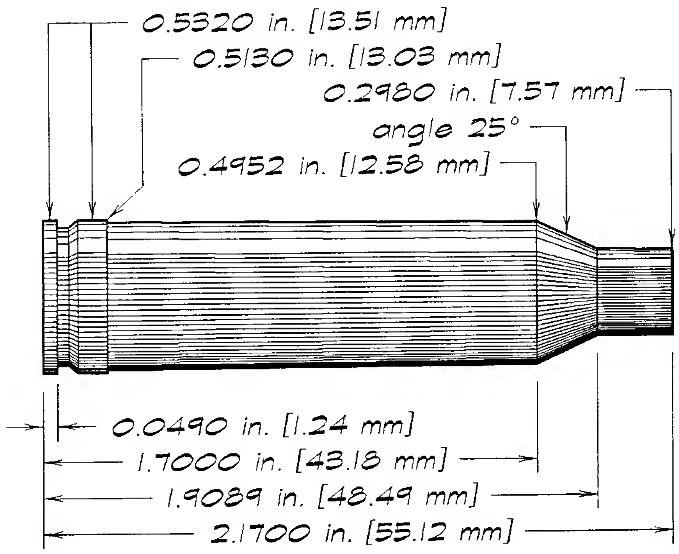
.264 bullet displaces
13.84 grains per inch.

Fire-form .243 Winchester brass with inert filler. Or resize .308 Winchester brass full-length in 6.5mm Redding sizer die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

6.5mm Remington Magnum

(SAAMI maximums)



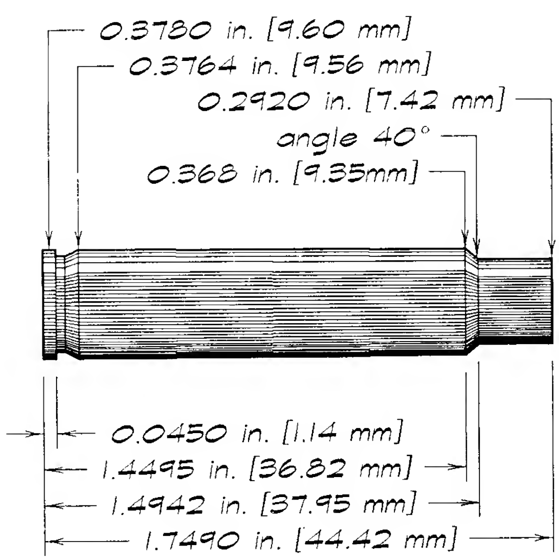
solid:
850 gr brass
100 gr water

.264 bullet displaces
13.84 grains per inch.

Recently manufactured factory brass should be plentiful. Or form from .350 Remington Magnum brass, in RCBS form and trim dies.

6.5mm Thompson/Center Ugalde (T/CU)

(RCBS drawing)



solid:
384 gr brass
45 gr water

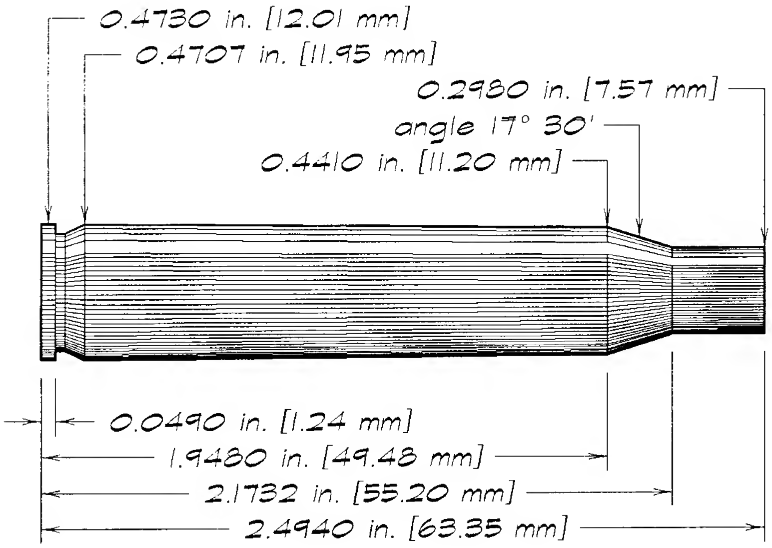
.264 bullet displaces
13.84 grains per inch.

Fire-form .223 Remington case with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

6.5mm-06

(RCBS drawing)



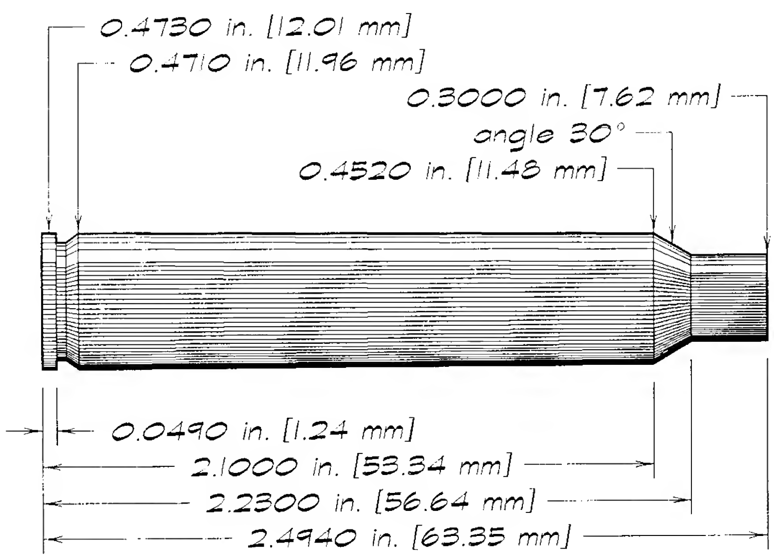
solid:
792 gr brass
93 gr water

.265 bullet displaces
13.95 grains per inch.

Fire-form .25-06 with inert filler. Or resize .270 or .280 full-length in 6.5mm-06 sizing die. Fire-form with inert filler. Or form from .30-06 Springfield brass, in RCBS form and trim dies.

6.5mm-06 Max M

(designer's specs)



solid:
826 gr brass
97 gr water

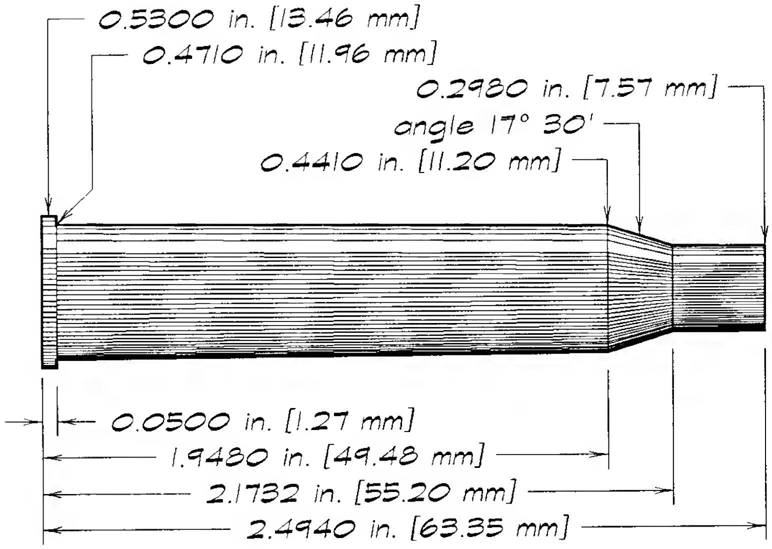
.264 bullet displaces
13.84 grains per inch.

Anneal neck, shoulder, and upper body of .30-06 Springfield, .280 Remington, or .270 Winchester brass. Resize full-length in 6.5mm-06 Max M sizer die. Fire-form with inert filler. Trim to 2.49 inches and deburr.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

6.5mm-06 Rimmed

(designer's specs)



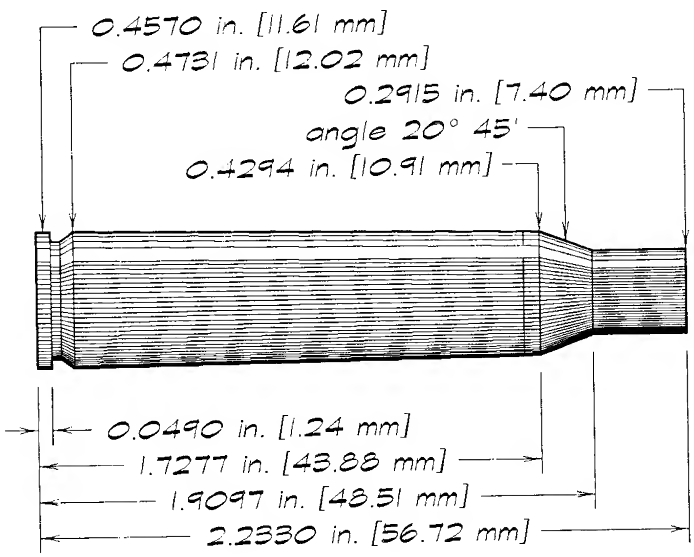
solid:
735 gr brass
86 gr water

.265 bullet displaces 13.95 grains per inch.

Trim .400-.350 NE brass to 2.5 inches and resize full-length in 6.5mm-06 sizer die. Fire-form with inert filler. Trim to 2.49 inches and deburr mouth.

6.5mm-.257 Roberts

(Speer manual number 4)



solid:
692 gr brass
81 gr water

.264 bullet displaces 13.84 grains per inch.

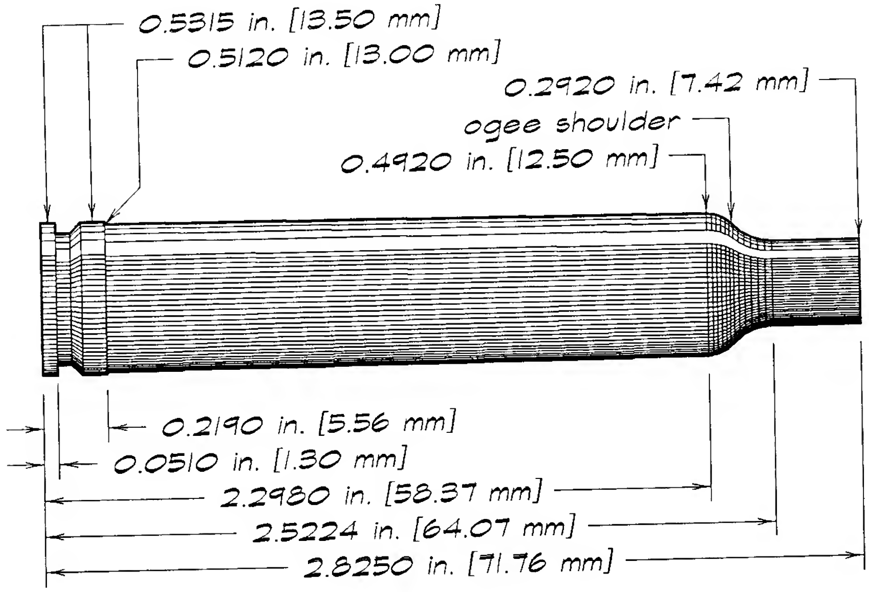
Fire-form .257 Roberts brass with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

6.5mm-.300 WWH

(unidentified drawing)

solid:
1,028 gr brass
121 gr water



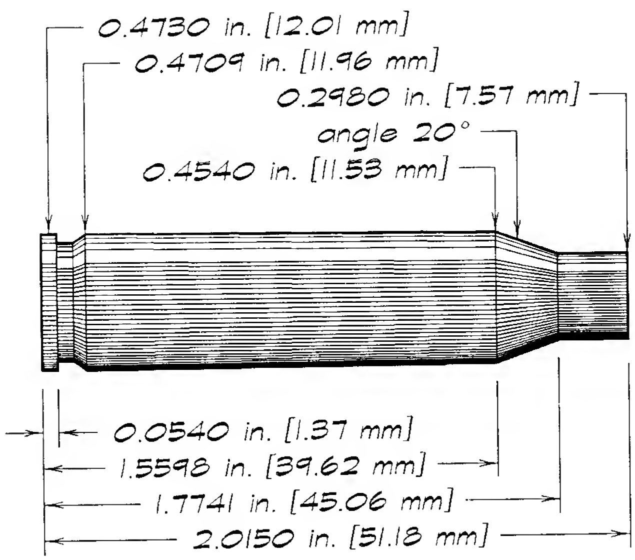
.264 bullet displaces 13.84 grains per inch.

Form from .300 Weatherby Magnum brass, in RCBS form-and-trim die.

6.5mm-.308 (Howell)

(designer's specs)

solid:
648 gr brass
76 gr water



.264 bullet displaces 13.84 grains per inch.

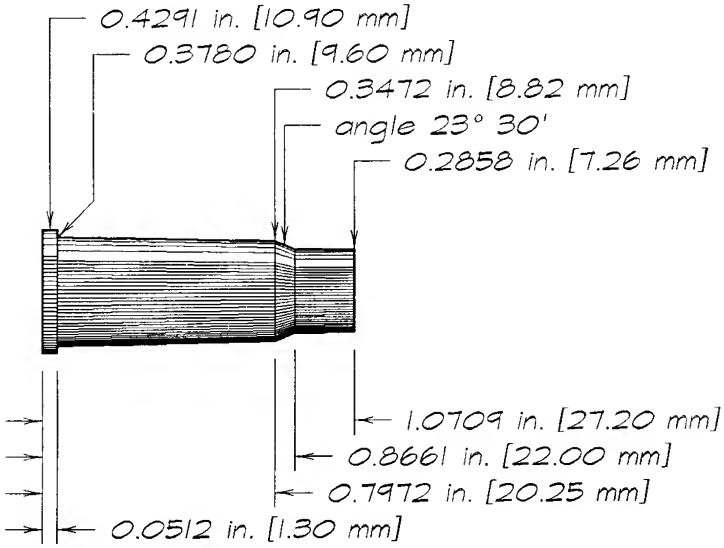
Fire-form .243 Winchester brass with inert filler. Or resize 7mm-08 Remington or .308 Winchester brass full-length in 6.5mm-.308 sizer die.

Anneal only by method shown in text. *Text explains use of "solid" and displacement figures.*

6.5x27mm Rimmed

(Triebel maximums)

solid:
218 gr brass
26 gr water



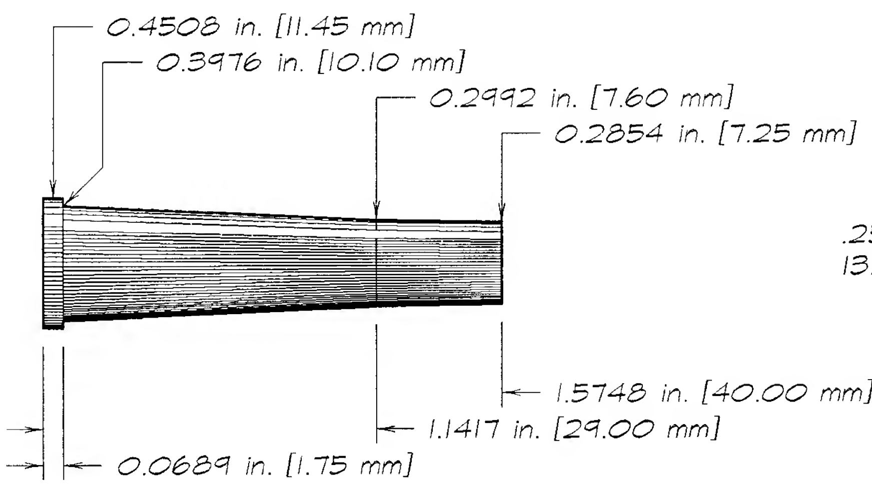
.258 bullet displaces
13.22 grains per inch.

Form from .38 Special or .357 Magnum brass, in RCBS form and trim dies.

6.5x40mm Rimmed

(Triebel maximums)

solid:
301 gr brass
35 gr water



.257 bullet displaces
13.12 grains per inch.

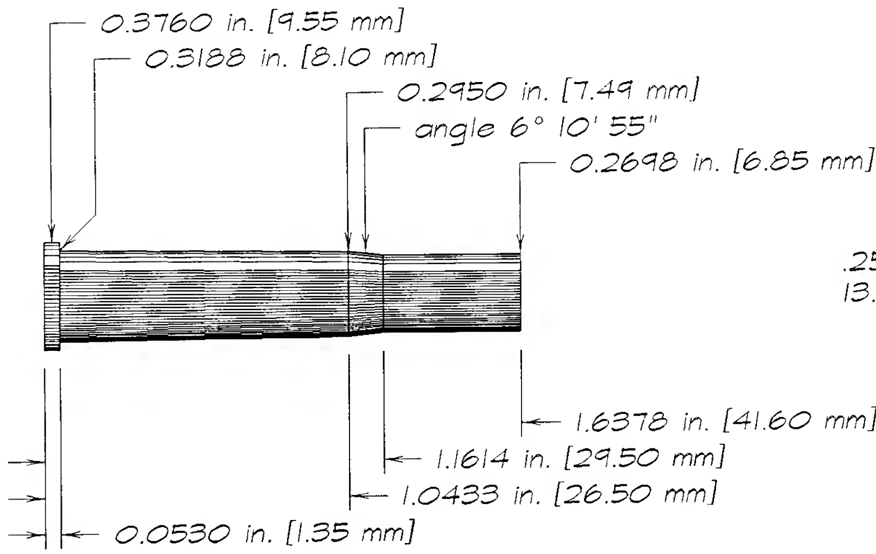
Form from .303 Savage brass, in RCBS base-form, form, and ream dies. Thin rim -- from front, not rear -- if necessary.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

6.5x41mm Rimmed

(Brno drawing, 1939)

solid:
248 gr brass
29 gr water

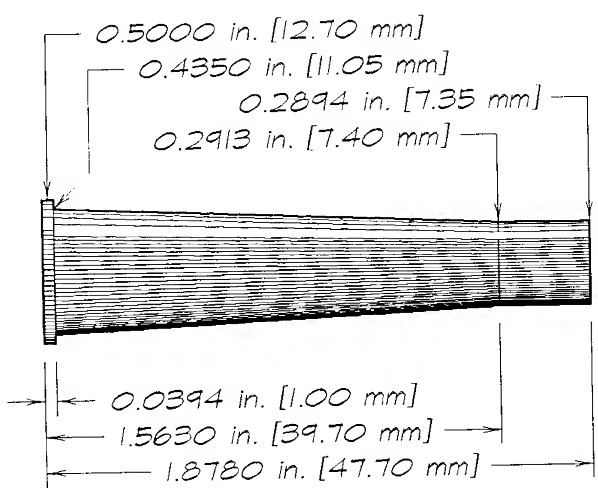


.256 bullet (?) displaces
13.02 grains per inch.

6.5x48mm Rimmed

(Triebel maximums)

solid:
395 gr brass
46 gr water



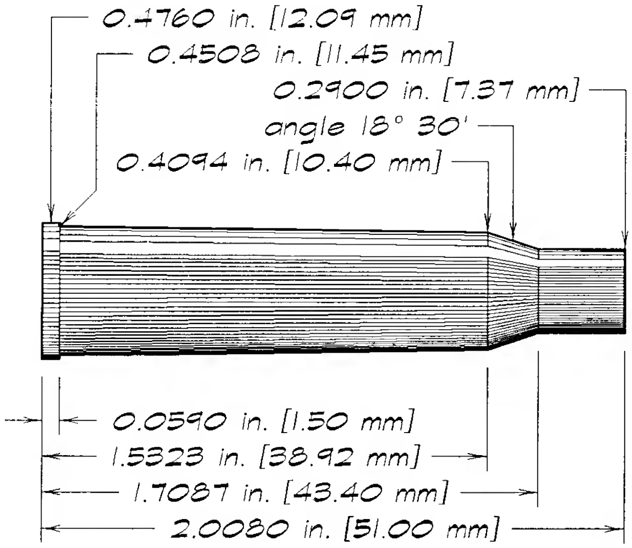
.260 bullet displaces
13.43 grains per inch.
.257 bullet displaces
13.12 grains per inch.

Form from .303 Savage brass, in RCBS form-and-trim die. Thin rim if necessary.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

6.5x50mm Arisaka

(RCBS drawing)



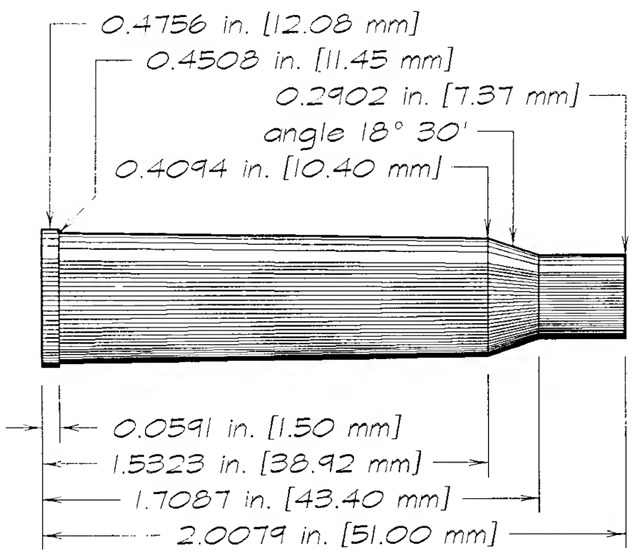
solid:
586 gr brass
69 gr water

.261 bullet displaces
13.53 grains per inch.

Form from .30-06 Springfield brass, in special RCBS base-form and form dies. (These base-form dies have to be used in an arbor press, and re-formed bases may require reswaging the primer pocket and redrilling the primer vent.)

6.5x51mm Rimmed (Arisaka)

(CIP maximums)



solid:
586 gr brass
69 gr water

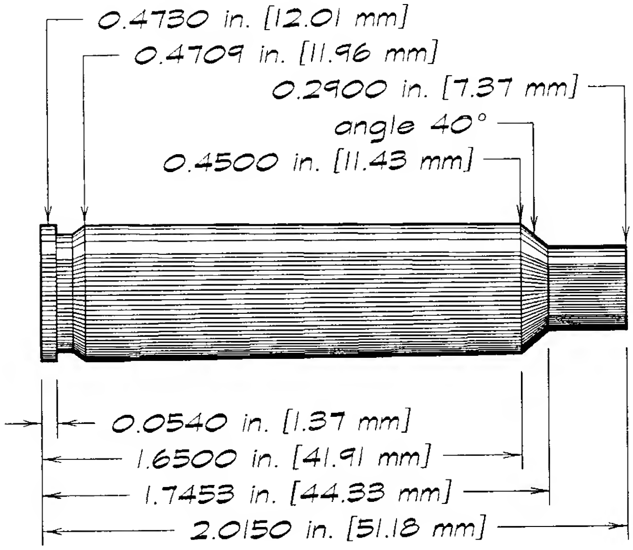
.261 bullet displaces
13.53 grains per inch.

Use factory 6.5x51mm Rimmed brass. Or anneal neck and shoulder of .303 Savage brass and resize full-length in 6.5x51mm Rimmed sizer die. Turn rim to 6.5x51mm R dimensions. Fire-form with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

6.5x52mm American (Layne Simpson specimen)

solid:
648 gr brass
76 gr water

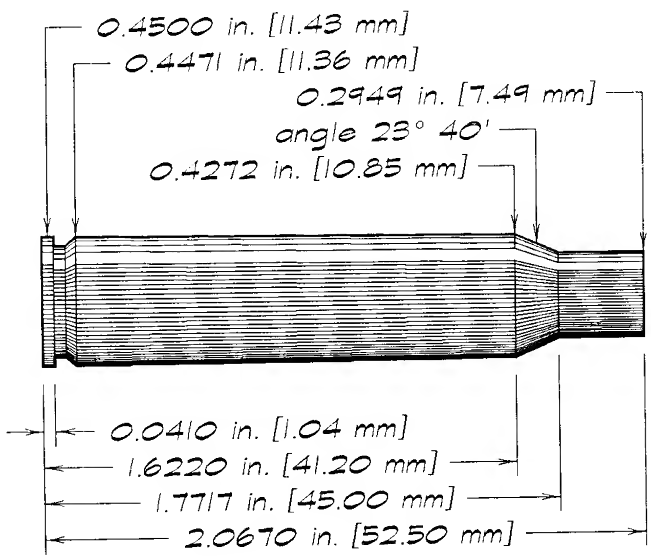


.264 bullet displaces 13.84 grains per inch.

Resize 7mm-08 Remington brass full-length in 6.5x52mm American sizer die. Fire-form with inert filler.

6.5x52mm Carcano (RCBS drawing)

solid:
597 gr brass
70 gr water



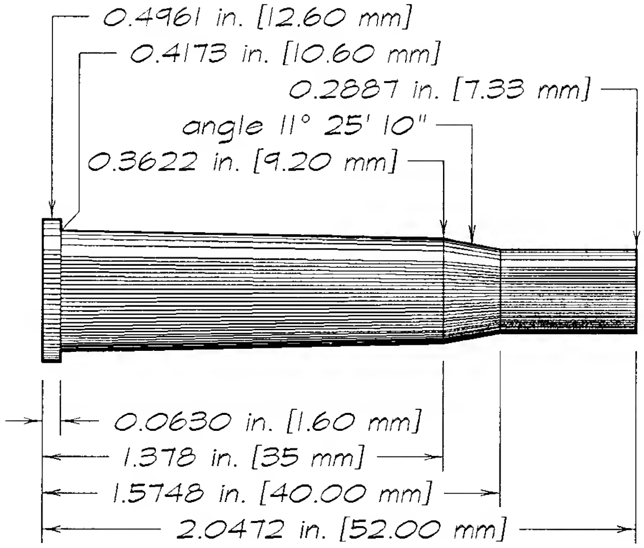
.264 bullet displaces 13.84 grains per inch.

Use recently manufactured 6.5mm Carcano brass.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

6.5x52mm Rimmed

(CIP maximums)



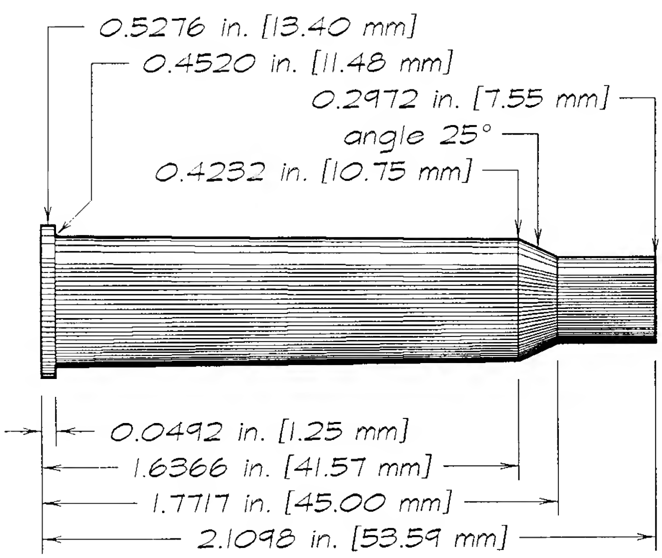
solid:
465 gr brass
55 gr water

.259 bullet displaces
13.32 grains per inch.

Use factory 6.5x52mm Rimmed brass. Or anneal neck and shoulder of .30-30 Winchester brass and resize full-length in 6.5x52mm Rimmed sizer die.

6.5x53mm Rimmed Mannlicher

(Triebel maximums)



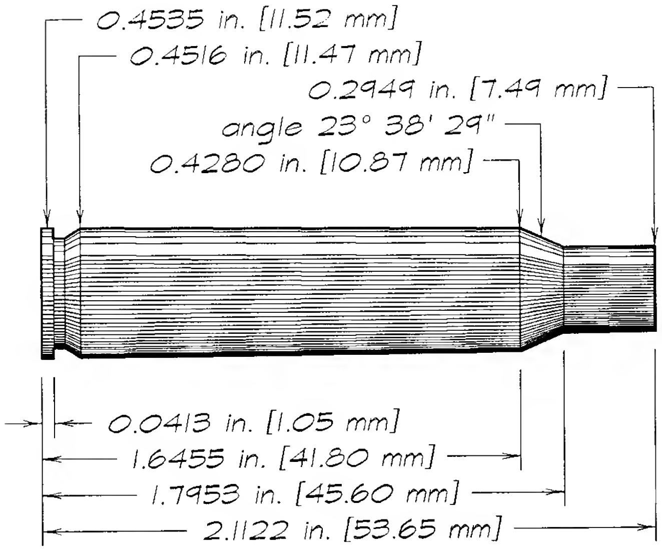
solid:
607 gr brass
71 gr water

.264 bullet displaces
13.84 grains per inch.

Form from .30-40 Krag or .303 British brass, in RCBS form dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

6.5x54mm Mannlicher Schoenauer (CIP maximums)

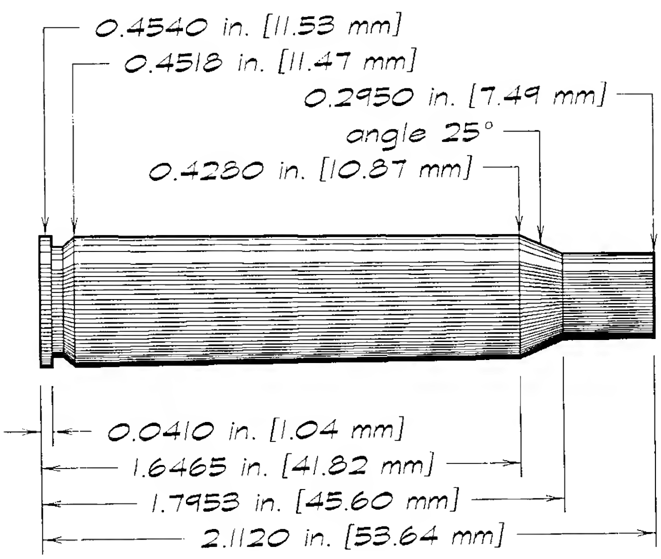


solid:
614 gr brass
72 gr water

.264 bullet displaces
13.84 grains per inch.

Use recently manufactured 6.5x54mm MS brass. Or form from .30-06 Springfield brass, in special RCBS base-form dies (in arbor press), then in form, trim, and ream dies. Drill primer vents. Swage primer pockets if necessary.

6.5x54mm Mannlicher-Schoenauer (RCBS drawing)



solid:
615 gr brass
72 gr water

.264 bullet displaces
13.84 grains per inch.

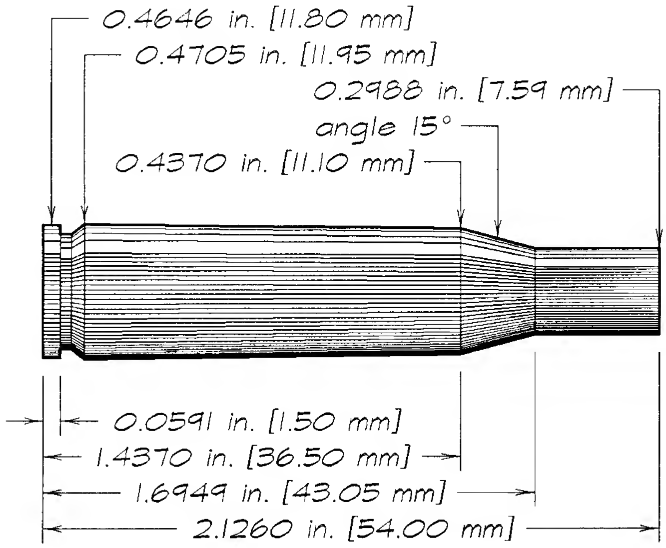
Use recently manufactured 6.5x54mm MS brass. Or form from .30-06 Springfield brass, in special RCBS base-form dies (in arbor press), then in RCBS form, trim, and ream dies. Drill primer vents. Swage primer pockets if necessary.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

6.5x54mm Mauser

(CIP maximums)

solid:
625 gr brass
73 gr water



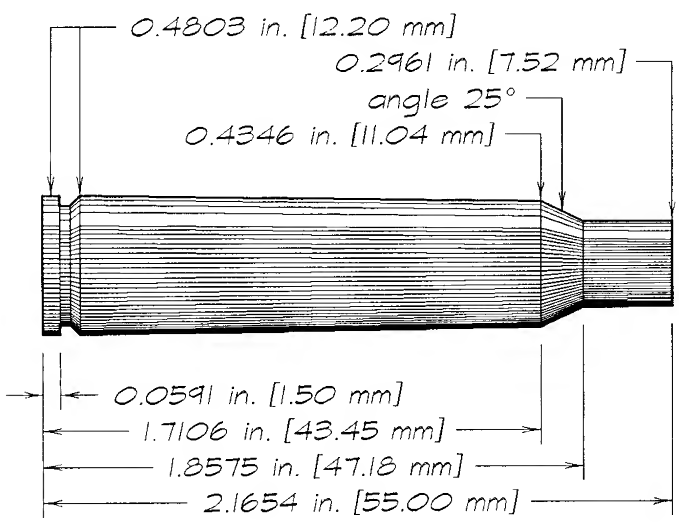
.261 bullet displaces
13.53 grains per inch.

Use factory 6.5x54mm Mauser brass. Or resize 7x57mm Mauser or 8x57mm Mauser brass full-length in 6.5x54mm Mauser sizer die, trim to 2.125 inches long, and deburr. Or resize .257 Roberts brass full-length in body of 6.5x54mm Mauser sizer die, fire-form with inert filler, trim to 2.125 inches long, and deburr.

6.5x55mm Swedish Mauser

(CIP maximums)

solid:
696 gr brass
82 gr water



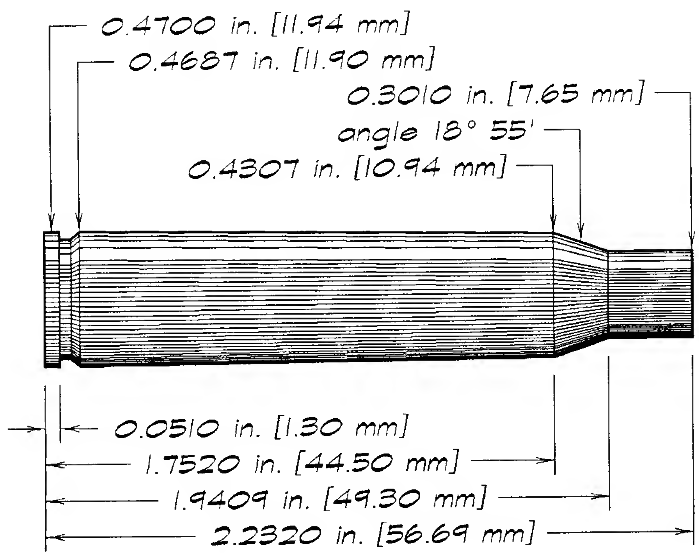
.264 bullet displaces
13.84 grains per inch.

Use factory 6.5x55mm brass.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

6.5x55mm Mauser

(RCBS drawing)



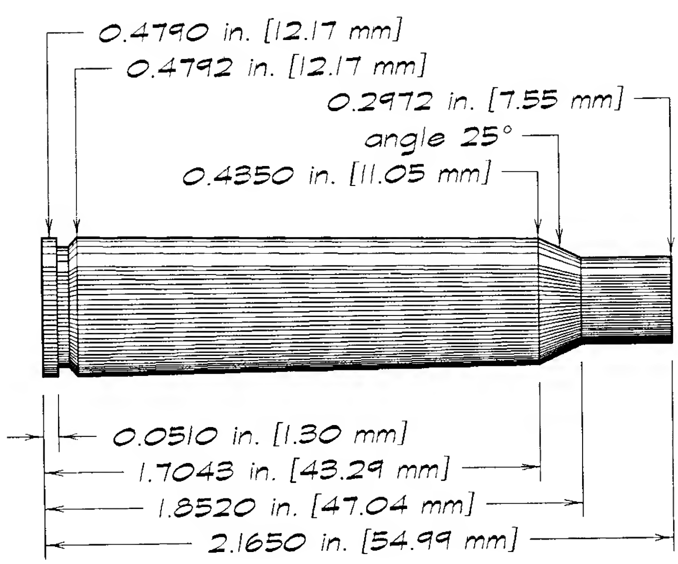
solid:
697 gr brass
82 gr water

.264 bullet displaces
13.84 grains per inch.

Use factory 6.5x55mm brass.

6.5x55mm Swedish Mauser

(SAAMI maximums)



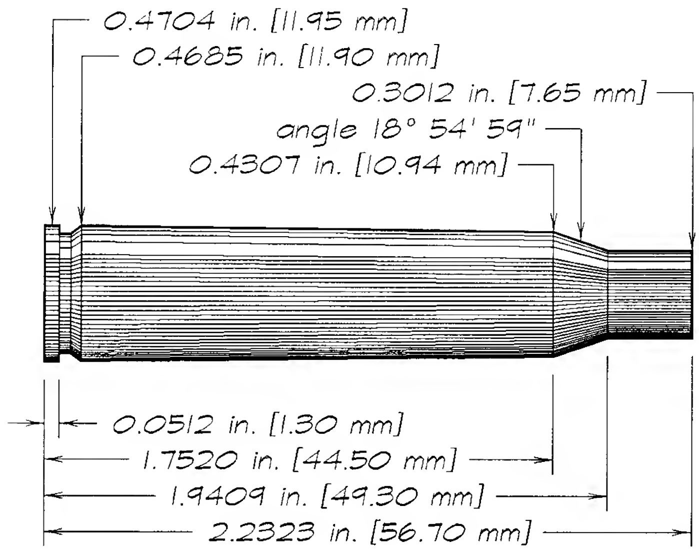
solid:
694 gr brass
81 gr water

.264 bullet displaces
13.84 grains per inch.

Use factory 6.5x55mm brass.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

6.5x57mm (CIP maximums)

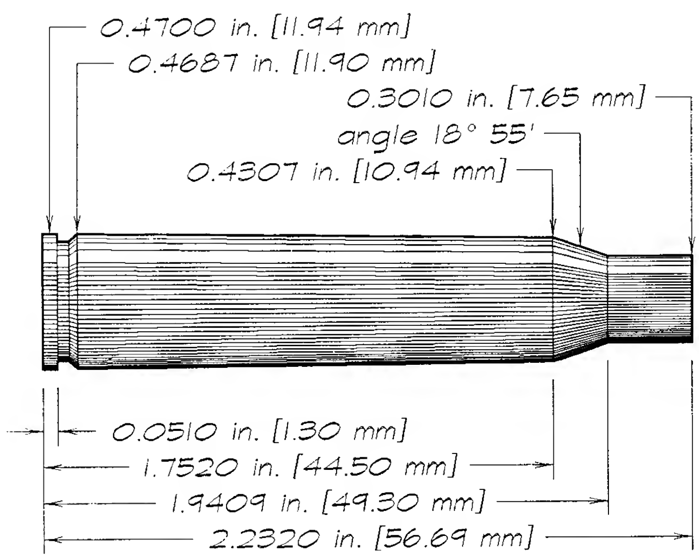


solid:
698 gr brass
82 gr water

.264 bullet displaces
13.84 grains per inch.

Use factory 6.5x57mm brass. Or resize 8x57mm Mauser brass full-length in 6.5x57mm sizer die.

6.5x57mm Mauser (RCBS drawing)



solid:
697 gr brass
82 gr water

.264 bullet displaces
13.84 grains per inch.

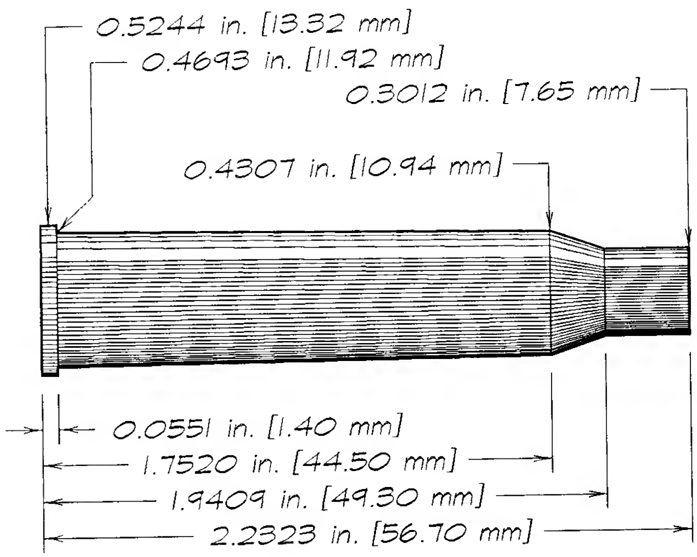
Use factory 6.5x57mm brass. Or resize 8x57mm Mauser brass full-length in 6.5x57mm sizer die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

6.5x57mm Rimmed

(CIP maximums)

solid:
699 gr brass
82 gr water



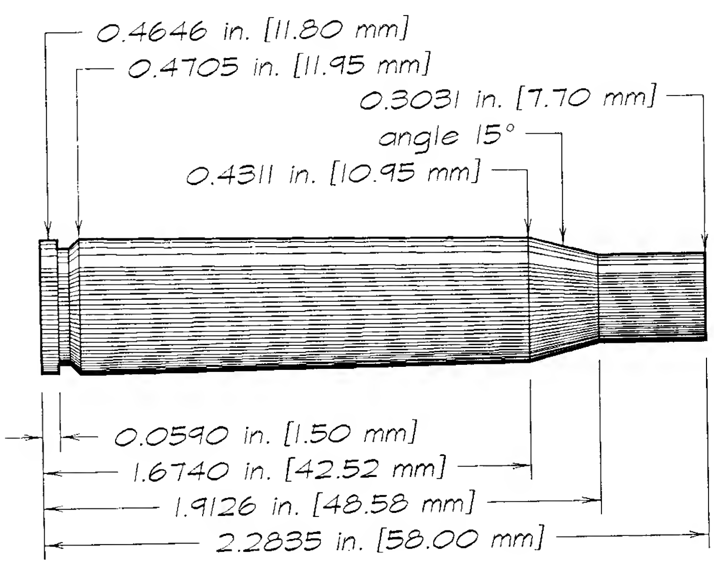
.264 bullet displaces 13.84 grains per inch.

Use factory 6.5x57mm Rimmed brass. Or anneal upper body of .444 Marlin brass, and form in RCBS form dies.

6.5x58mm Mauser

(CIP maximums)

solid:
693 gr brass
81 gr water



.264 bullet displaces 13.84 grains per inch.

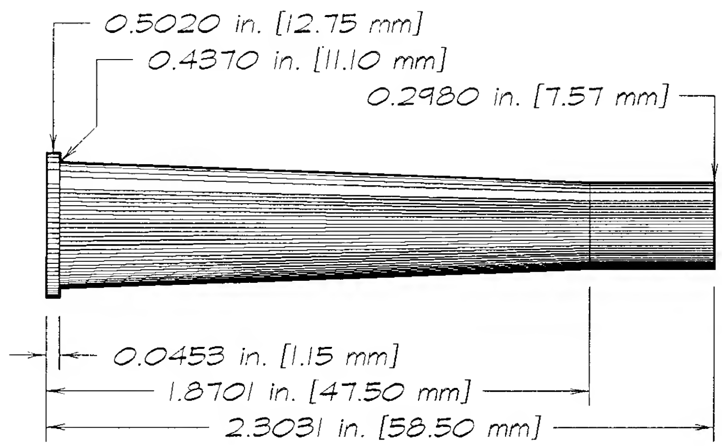
Use factory 6.5x58mm Mauser brass. Or form from .270 Winchester or .30-06 Springfield brass, in RCBS form-and-trim die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

6.5x58mm Rimmed

(CIP maximums)

solid:
490 gr brass
58 gr water



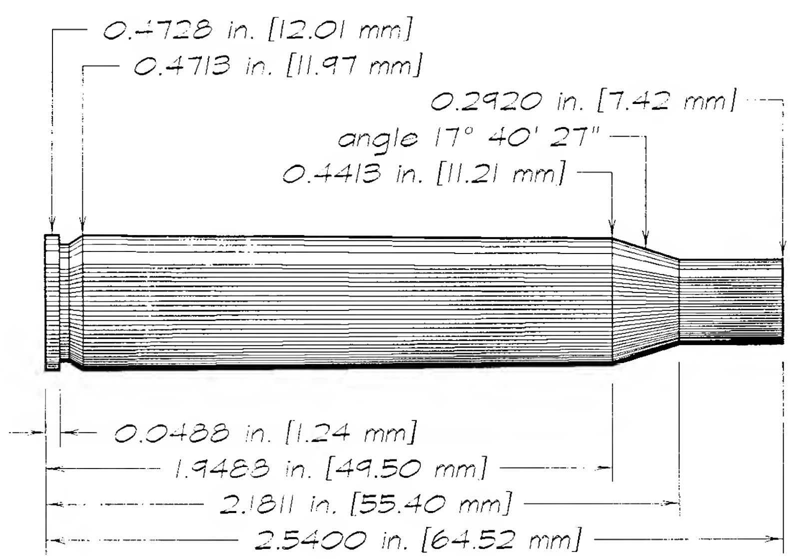
.261 bullet displaces
13.53 grains per inch.

Use recently manufactured 6.5x58mm Rimmed brass. Or form from .30-30 Winchester brass (which has to be expanded at the base) or .30-40 Krag brass (which has to be swaged down at the base), in respective RCBS form dies.

6.5x64mm Brenneke

(CIP maximums)

solid:
796 gr brass
93 gr water



.264 bullet displaces
13.84 grains per inch.

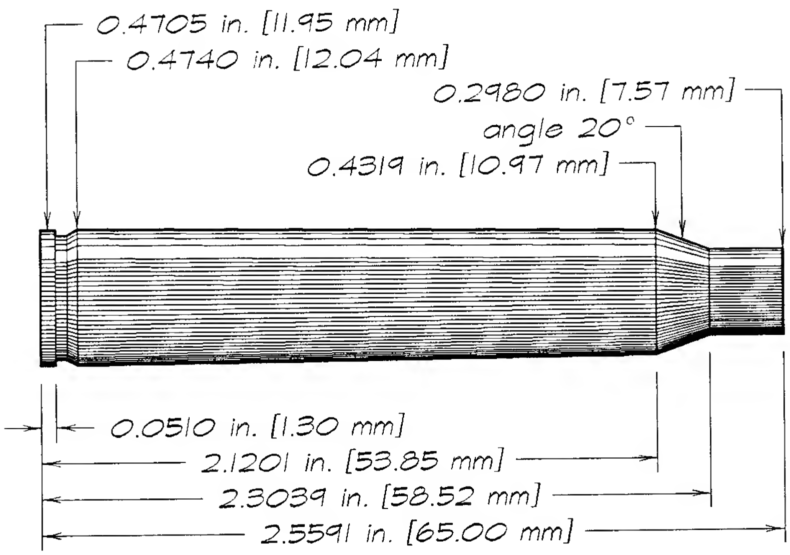
Resize .270 Winchester brass full-length in 6.5x64mm sizer die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

6.5x65mm RWS

(Dynamit Nobel drawing)

solid:
833 gr brass
98 gr water

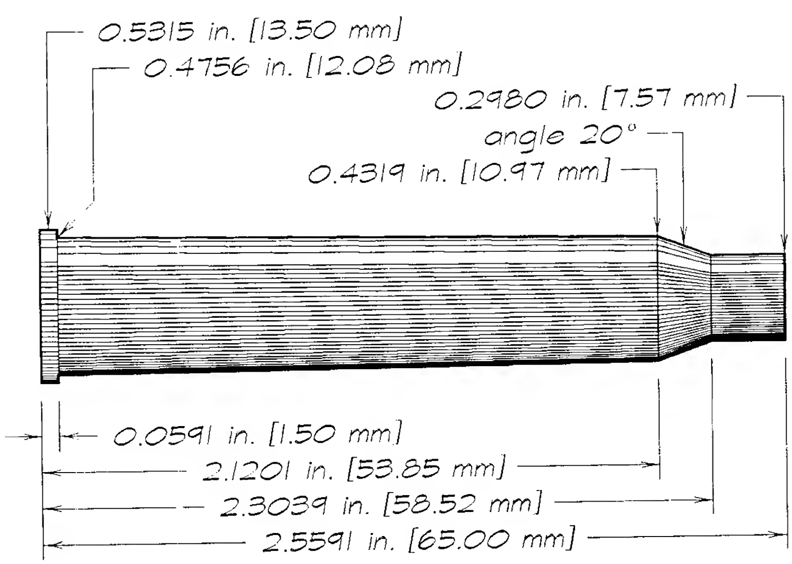


.264 bullet displaces
13.84 grains per inch.

6.5x65mm RWS Rimmed

(Dynamit Nobel drawing)

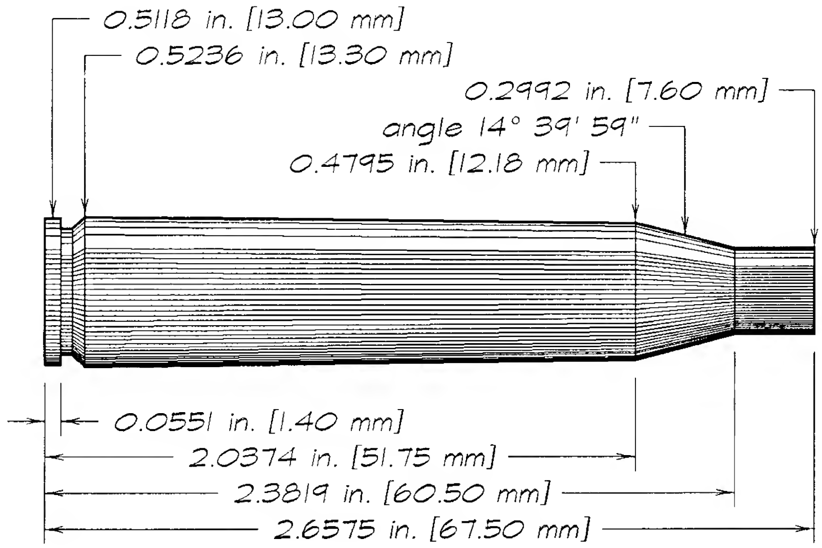
solid:
835 gr brass
98 gr water



.264 bullet displaces
13.84 grains per inch.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

6.5x68mm (CIP maximums)

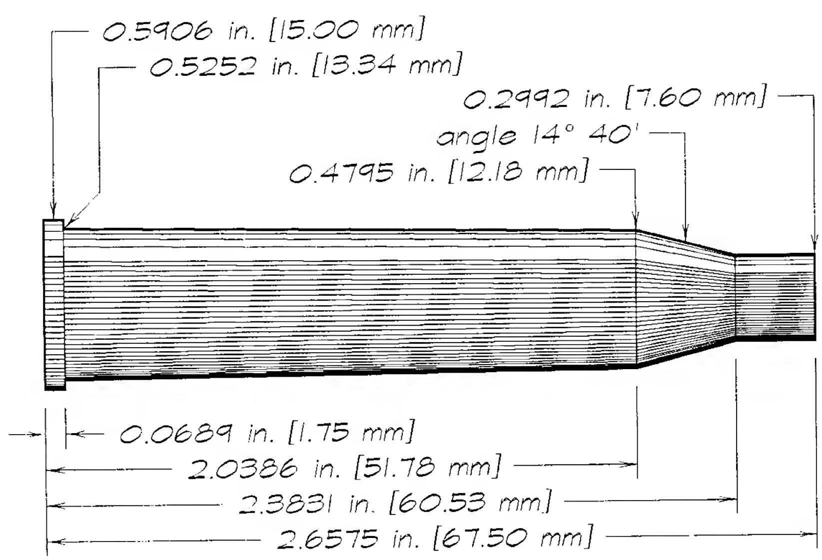


solid:
1,009 gr brass
118 gr water

.264 bullet displaces
13.84 grains per inch.

Use factory 6.5x68mm brass. Or form from 8x68mm S brass, in RCBS form die.

6.5x68mm Rimmed (CIP maximums)



solid:
1,016 gr brass
119 gr water

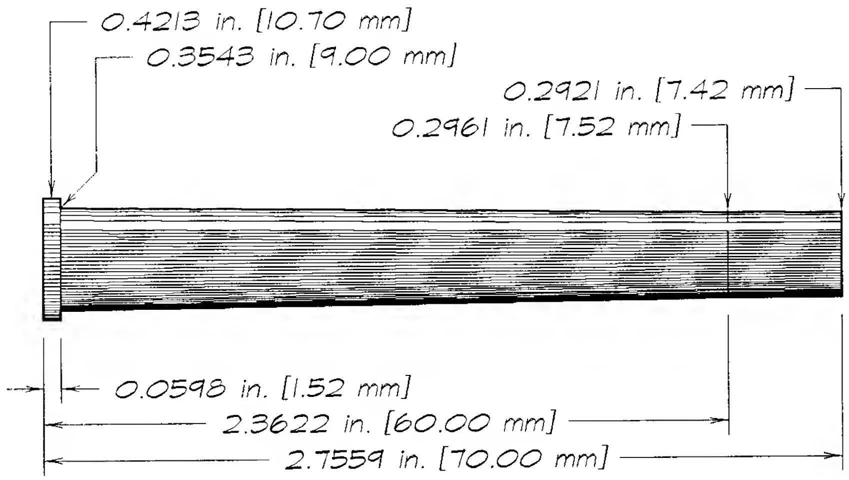
.264 bullet displaces
13.84 grains per inch.

Use factory 6.5x68mm Rimmed brass. No satisfactory substitute exists.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

6.5x70mm Rimmed (Triebel maximums)

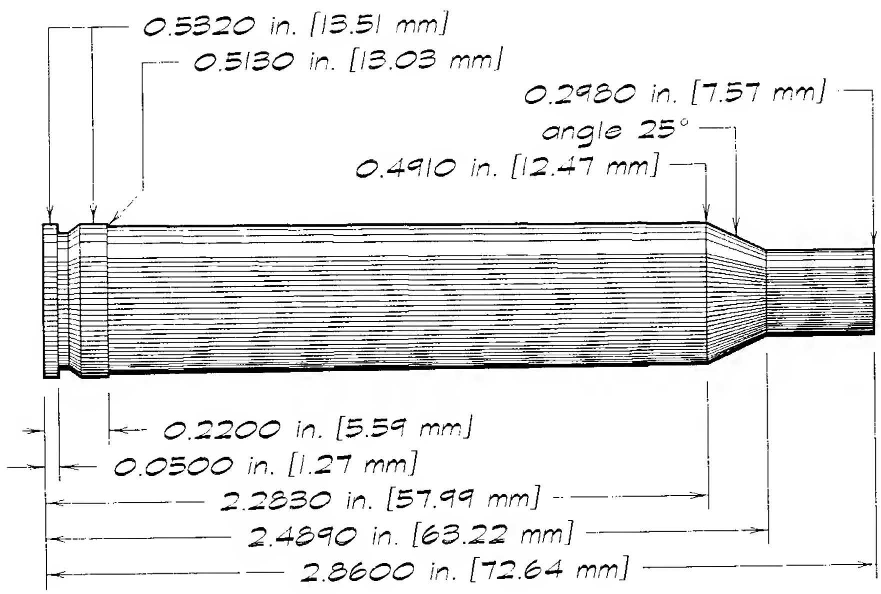
solid:
492 gr brass
58 gr water



.261 bullet displaces 13.53 grains per inch.

6.5x72mm (unidentified drawing)

solid:
1,120 gr brass
131 gr water



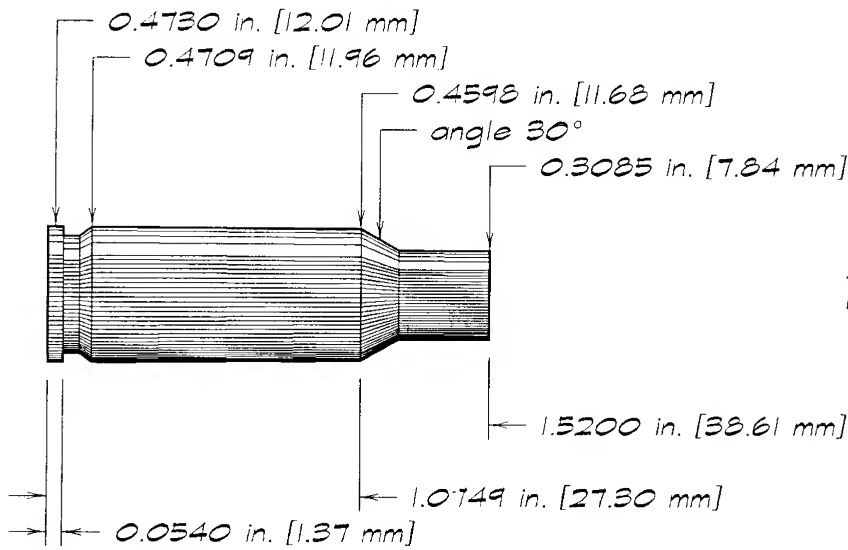
.264 bullet displaces 13.84 grains per inch.

Anneal neck and shoulder of .300 H&H Magnum brass. Resize full-length in 6.5x72 sizer die. Fire-form with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

7mm Bench Rest Remington (SAAMI maximums)

solid:
468 gr brass
55 gr water

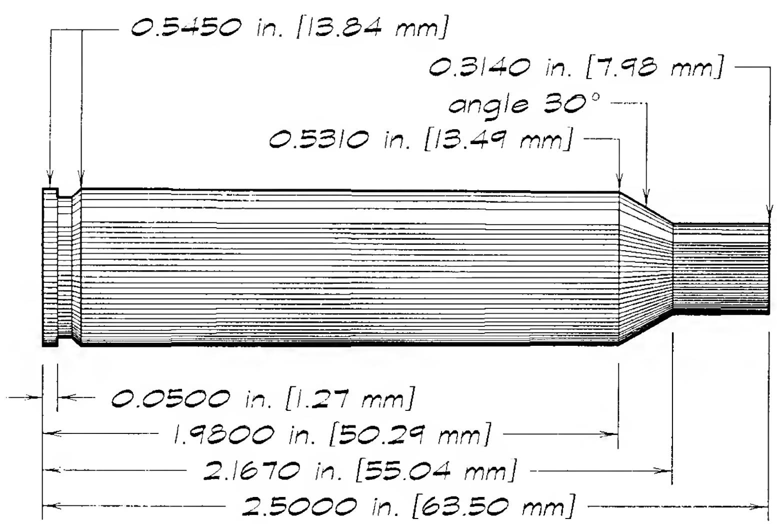


.284 bullet displaces
16.02 grains per inch.

Anneal forward ½ inch of Remington BR brass and form in RCBS form, trim, and neck-ream dies.

7mm Dakota (Dakota Arms drawing)

solid:
1,073 gr brass
126 gr water

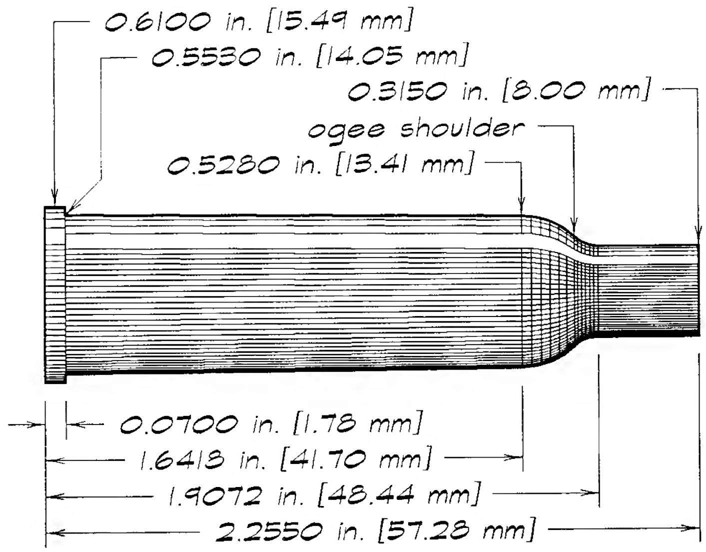


.284 bullet displaces
16.02 grains per inch.

Anneal neck and shoulder of .404 Jeffery brass. Trim to 2.6 inches. Size full-length in 7mm Dakota sizing die. Ream inside neck. Trim to 2½ inches; deburr.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

7mm Gradle Express (F K Elliott drawing)

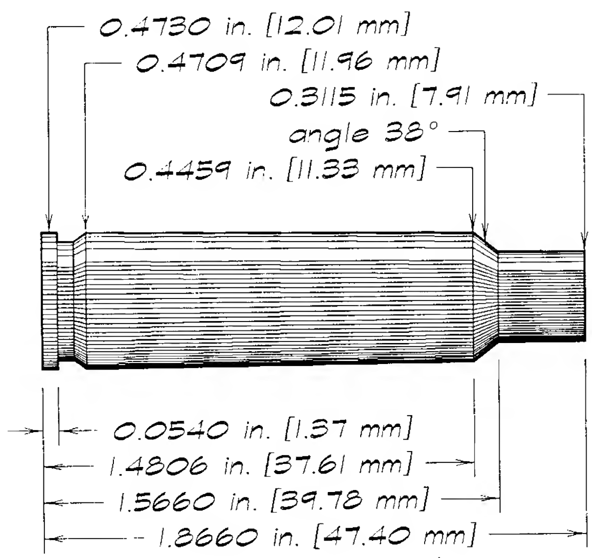


solid:
1,012 gr brass
119 gr water

.284 bullet displaces
16.02 grains per inch.

Form from .348 Winchester brass, in RCBS form and trim dies. Fire-form with inert filler.

7mm IHMSA International (IHMSA specs)



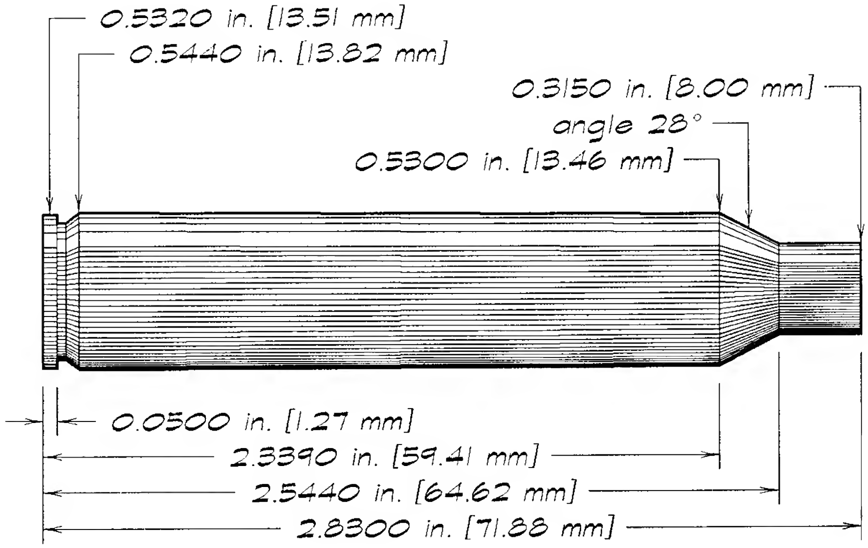
solid:
546 gr brass
64 gr water

.285 bullet displaces
16.13 grains per inch.

Use factory IHMSA brass. Or resize .243 Winchester brass full-length in body of 7mm IHMSA sizer die (without expander stem), trim to length, and fire-form with inert filler. Or resize .308 Winchester brass full-length in 7mm IHMSA sizer die, then fire-form with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

7mm Imperial Magnum (Imperial drawing, 1993)

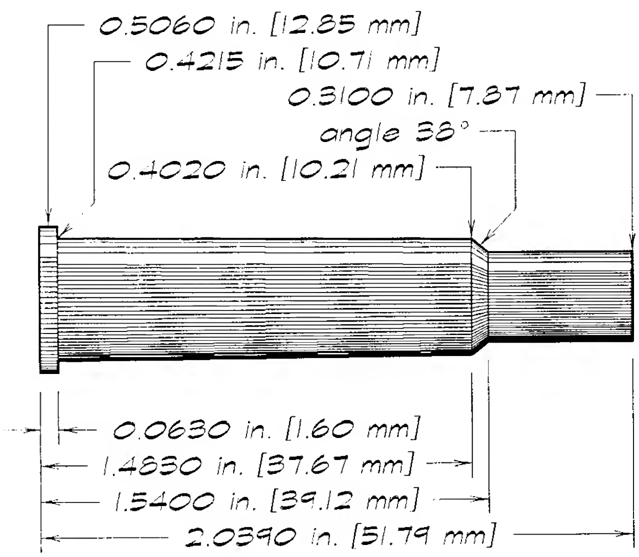


solid:
1,241 gr brass
146 gr water

.284 bullet displaces 16.02 grains per inch.

Use factory 7mm Imperial brass. Or form from .404 Jeffery brass, in RCBS form, trim, and neck-ream dies.

7mm International Rimmed (David J LeGate)



solid:
522 gr brass
61 gr water

.284 bullet displaces 16.02 grains per inch.

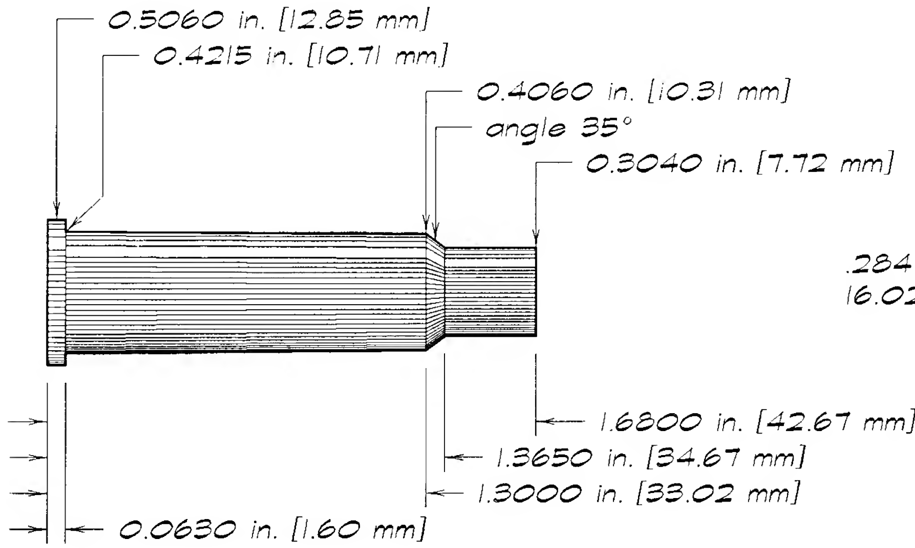
Resize .30-30 Winchester brass full-length in 7mm International Rimmed sizer die. Fire-form with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

7mm Jurras

(Jurras drawing)

solid:
443 gr brass
52 gr water



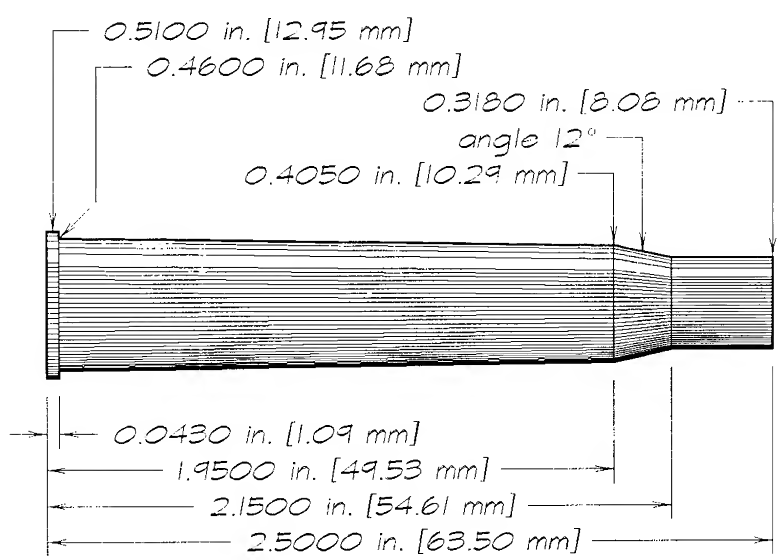
.284 bullet displaces
16.02 grains per inch.

Anneal neck and shoulder of .30-30 Winchester brass. Form and trim in RCBS form-and-trim die. Ream inside neck with RCBS neck-ream set. Fire-form with inert filler.

7mm Magnum Flanged Holland & Holland

(Birmingham Proof House)

solid:
734 gr brass
86 gr water



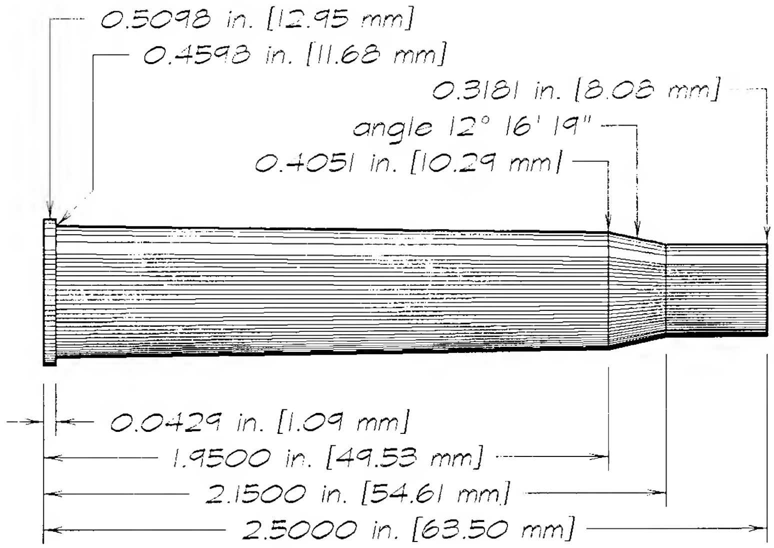
.284 bullet displaces
16.02 grains per inch.

USe recently manufactured 7mm Magnum Flanged H&H brass. Or form from 9.3x74mm Rimmed brass, in RCBS form and trim dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

7mm Magnum Flanged Holland & Holland (CIP maximums)

solid:
734 gr brass
86 gr water

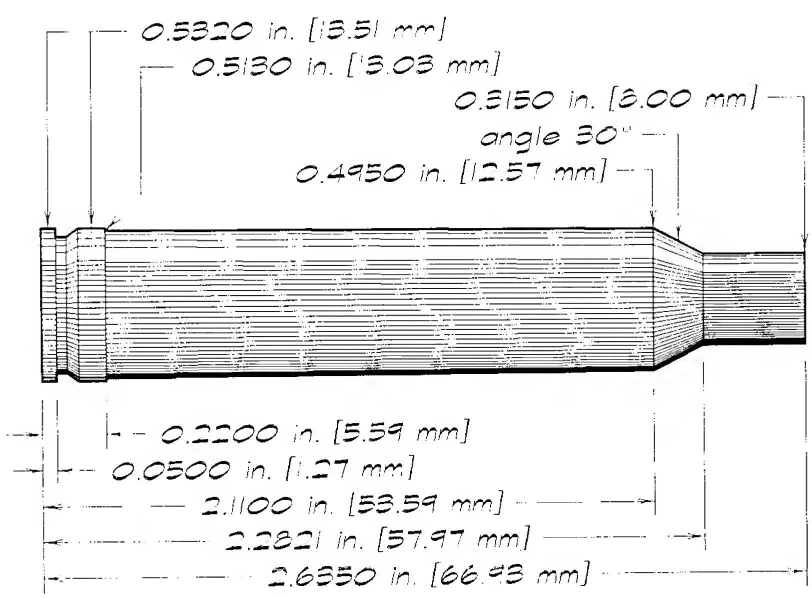


.284 bullet displaces
16.02 grains per inch.

Use recently manufactured 7mm Magnum Flanged H&H brass. Or form from 9.3x74mm Rimmed brass, in RCBS form and trim dies.

7mm Mashburn Magnum (Speer manual number 4)

solid:
958 gr brass
112 gr water



.284 bullet displaces
16.02 grains per inch.

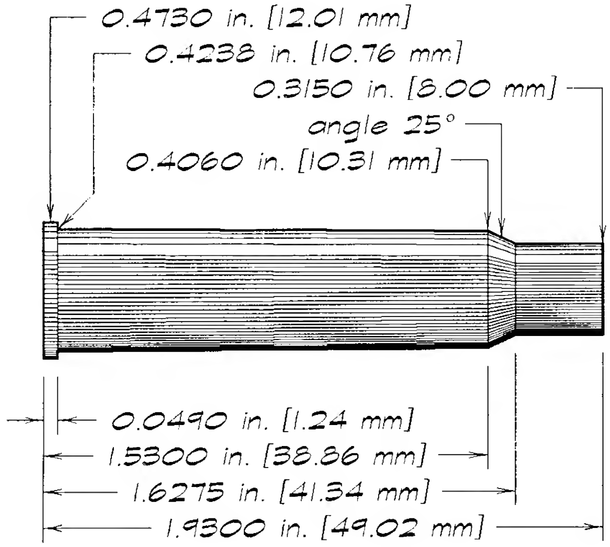
Anneal neck and shoulder of .300 H&H Magnum brass. Resize full-length in body of 7mm Mashburn Magnum sizer die. Trim to 2.635 inches. Deburr. Fire-form with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

7mm Merrill

(unidentified drawing)

solid:
496 gr brass
58 gr water



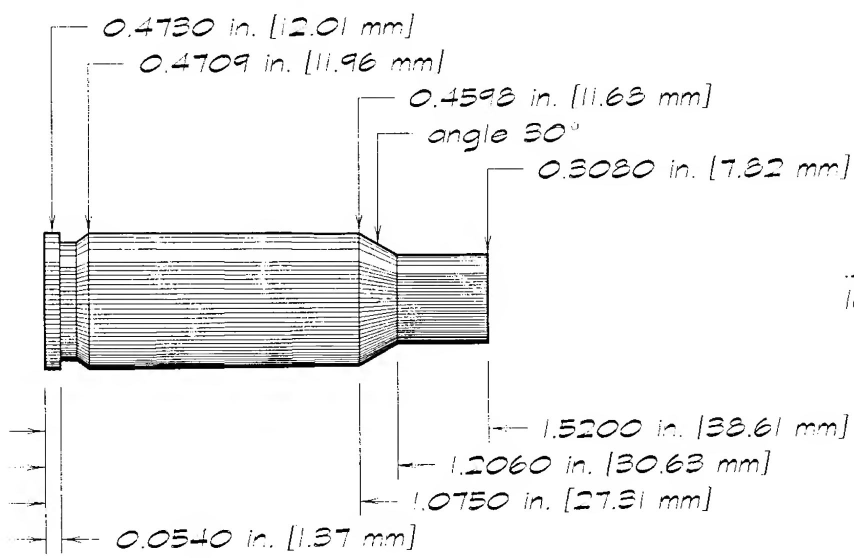
.284 bullet displaces
16.02 grains per inch.

Anneal neck and shoulder of .225 Winchester brass. Fire-form with inert filler.

7mm MS

(Remington drawing, 1978)

solid:
431 gr brass
51 gr water



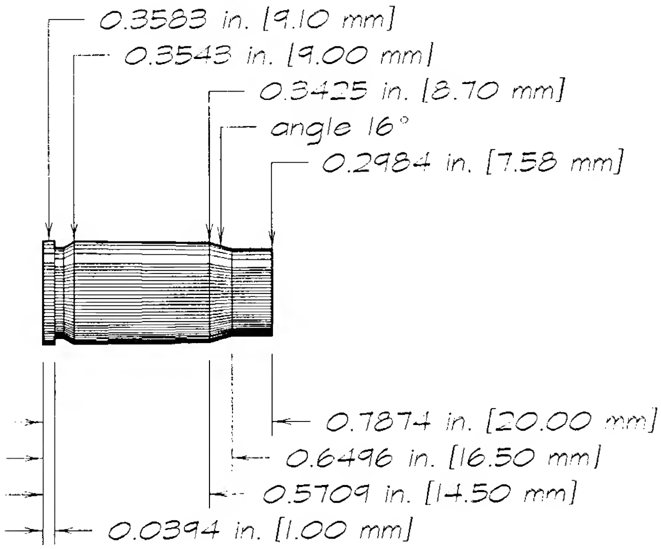
.284 bullet displaces
16.02 grains per inch.

Anneal shoulder and upper body of 7mm-08 Remington and form in RCBS form and trim dies. Ream neck, in RCBS ream die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

7mm Nambu

(Sadamitsu Taguchi)



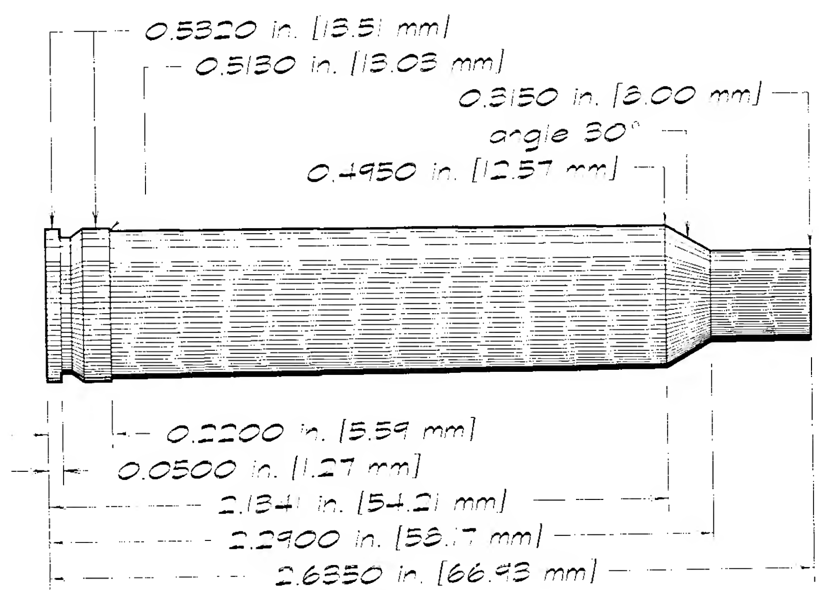
solid:
151 gr brass
17 gr water

.280 bullet displaces
15.57 grains per inch.

Use factory 7mm Nambu brass. Or form from .30 Carbine brass, in special RCBS base-form die and form, trim, and ream dies.

7mm Quackenbush Magnum

(designer's specs)



solid:
1,045 gr brass
123 gr water

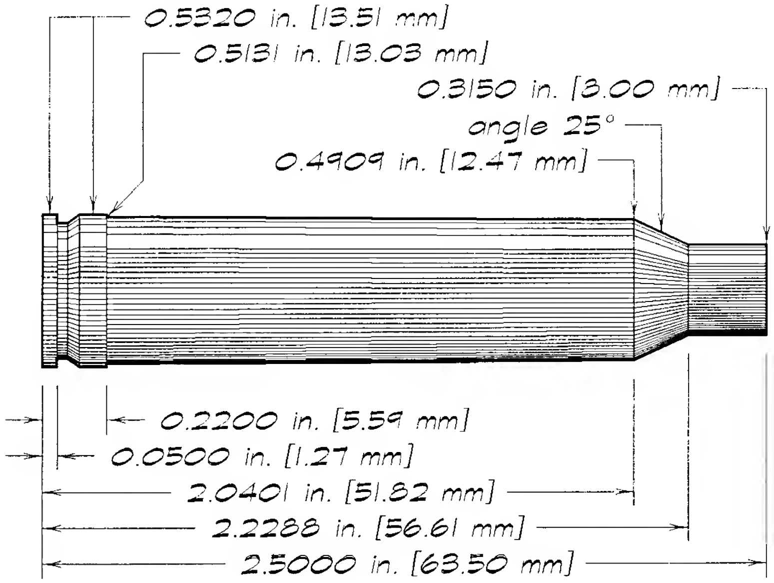
.284 bullet displaces
16.02 grains per inch.

Resize .300 Winchester Magnum brass full-length in 7mm Quackenbush sizer die. Fire-form with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

7mm Remington Magnum

(SAAMI maximums)



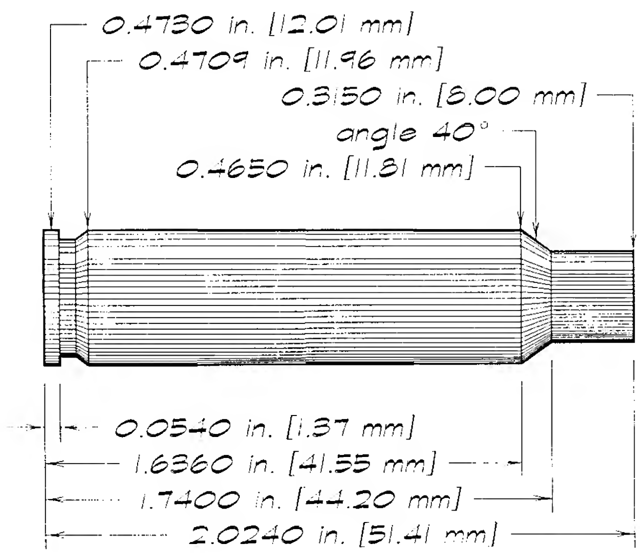
solid:
999 gr brass
117 gr water

.284 bullet displaces
16.02 grains per inch.

This is one of the most readily available of currently manufactured cartridges. But if you have to, you can form 7mm Remington Magnum cases from virtually any H&H-Magnum-based brass that's long enough. RCBS makes form dies to form 7mm Magnum cases from .300 Winchester, H&H, or Weatherby Magnum brass.

7mm SGLC

(David J LeGate)



solid:
667 gr brass
78 gr water

.284 bullet displaces
16.02 grains per inch.

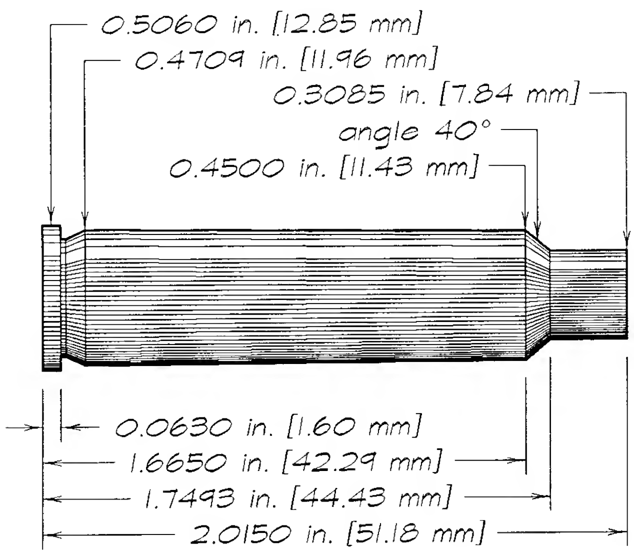
Fire-form .243 Winchester brass with inert filler. Or resize .308 Winchester brass full-length in 7mm SGLC sizer die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

7mm STE

(Layne Simpson specimen)

solid:
699 gr brass
82 gr water



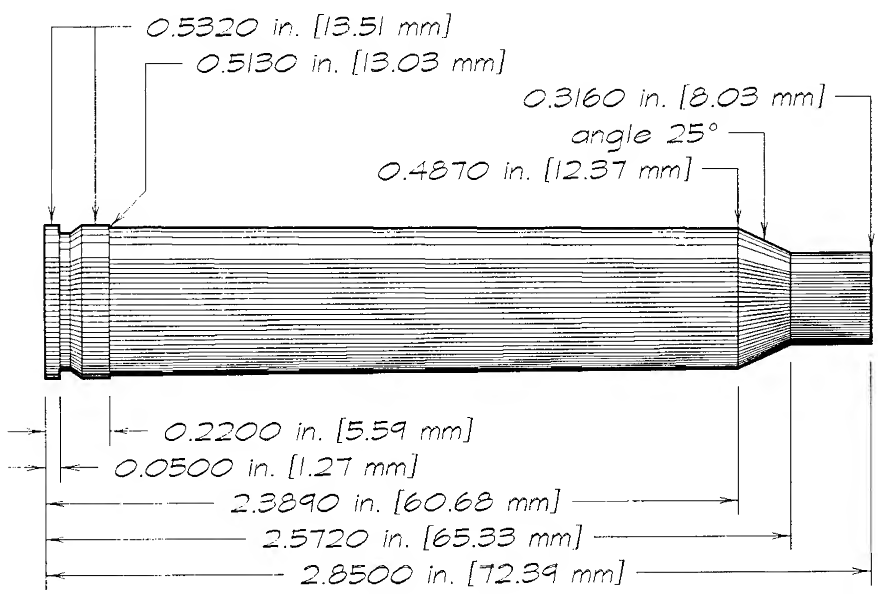
.284 bullet displaces
16.02 grains per inch.

Resize .307 Winchester brass full-length in 7mm STE sizer die. Fire-form with inert filler.

7mm STW

(A-Square maximums)

solid:
1,150 gr brass
135 gr water



.284 bullet displaces
16.02 grains per inch.

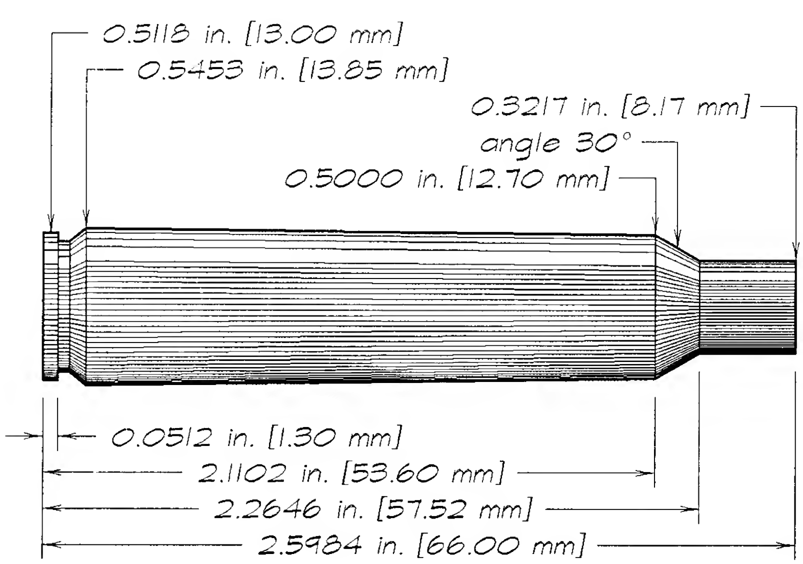
Use A-Square or A-Cube factory brass. Or resize 8mm Remington Magnum brass full-length in 7mm STW sizer die. Or resize .300 H&H Magnum brass full-length in 7mm STW sizer die and fire-form with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

7mm Super Express vom Hofe

(CIP maximums)

solid:
1,087 gr brass
128 gr water



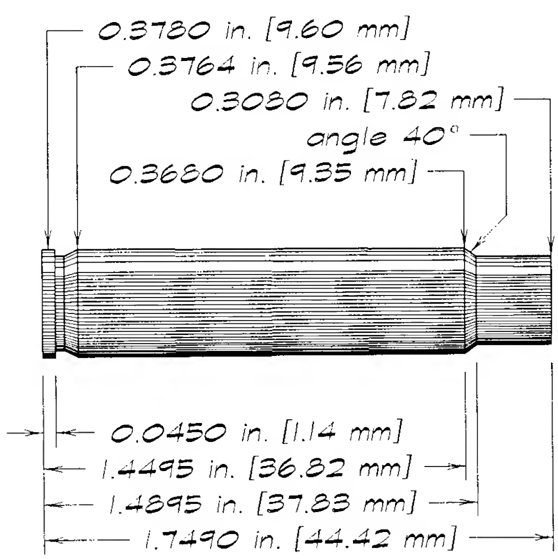
.285 bullet displaces
16.13 grains per inch.

Use factory 7mm SE vH brass. No satisfactory substitute exists.

7mm T/CU

(RCBS drawing)

solid:
388 gr brass
46 gr water



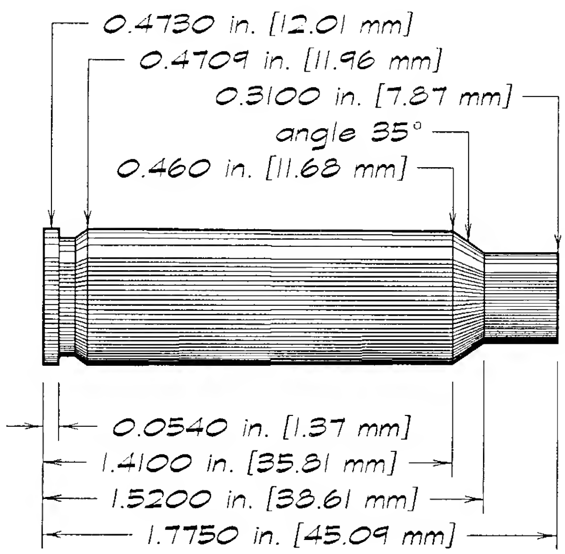
.284 bullet displaces
16.02 grains per inch.

Form from .223 Remington brass, in RCBS form die.

Anneal only by method shown in text. *Text explains use of "solid" and displacement figures.*

7mm TNT

(David J LeGate)



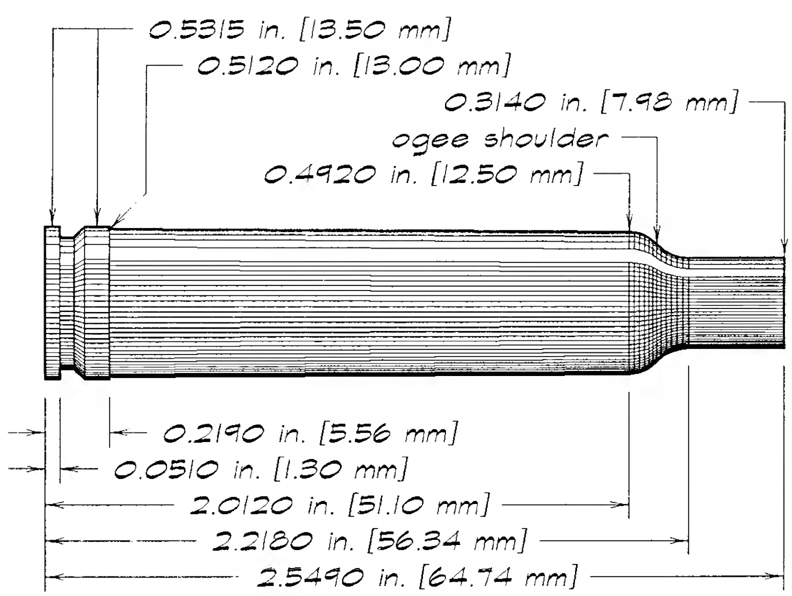
solid:
577 gr brass
68 gr water

.284 bullet displaces
16.02 grains per inch.

Form from .308 Winchester, in RCBS form-and-trim dies.

7mm Weatherby Magnum

(SAAMI maximums.)



solid:
995 gr brass
117 gr water

.284 bullet displaces
16.02 grains per inch.

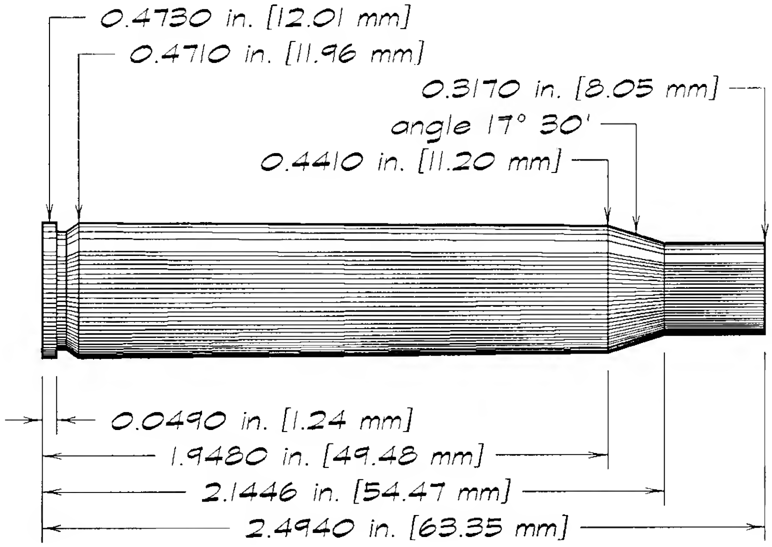
Form from .300 Winchester Magnum or .300 H&H Magnum brass, in respective RCBS form and trim dies. Deburr. Fire-form with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

7mm-06

(Speer manual number 4)

solid:
792 gr brass
93 gr water



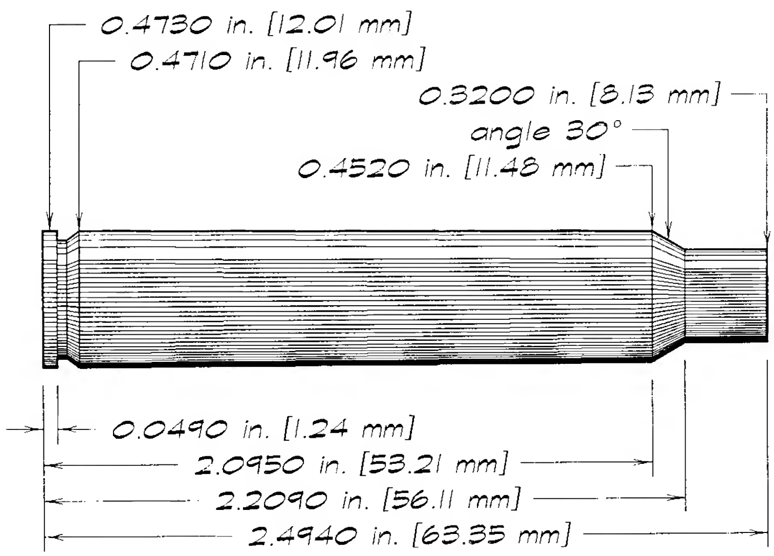
.284 bullet displaces
16.02 grains per inch.

Use .280 Remington (or 7mm Express Remington) brass. Or resize .30-06 Springfield brass full-length in 7mm-06 sizer die.

7mm-06 Max M

(designer's specs)

solid:
825 gr brass
97 gr water



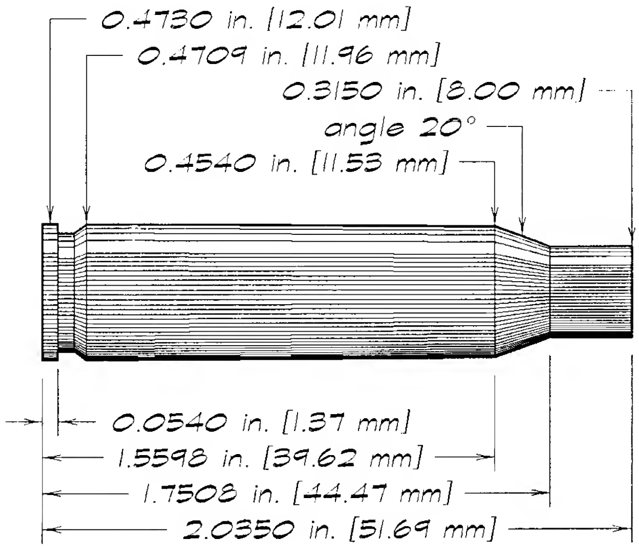
.284 bullet displaces
16.02 grains per inch.

Anneal neck, shoulder, and upper body of .30-06 Springfield brass. Resize full-length in 7mm-06 Max M sizer die. Fire-form with inert filler. Trim. Deburr.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

7mm-08 Remington

(SAAMI maximums)



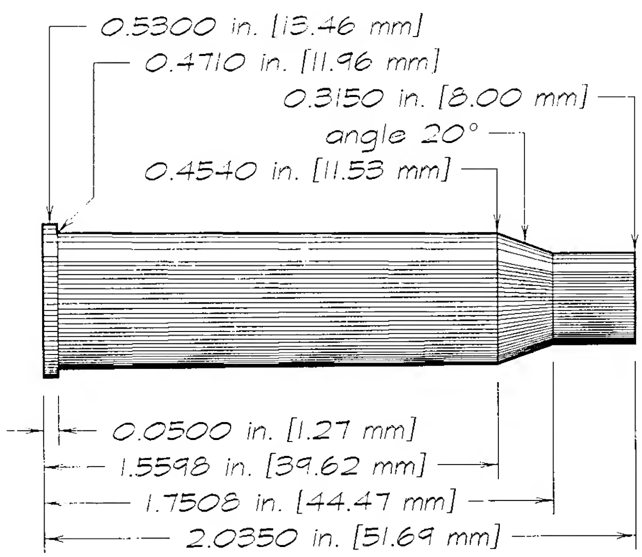
solid:
651 gr brass
76 gr water

.284 bullet displaces
16.02 grains per inch.

Cuurently manufactured factory brass should be easily available. Or fire-form .243 Winchester case with inert filler. Or resize .308 Winchester case full-length in 7mm-08 form-and-trim die.

7mm-08 Remington Rimmed

(designer's specs)



solid:
685 gr brass
80 gr water

.284 bullet displaces
16.02 grains per inch.

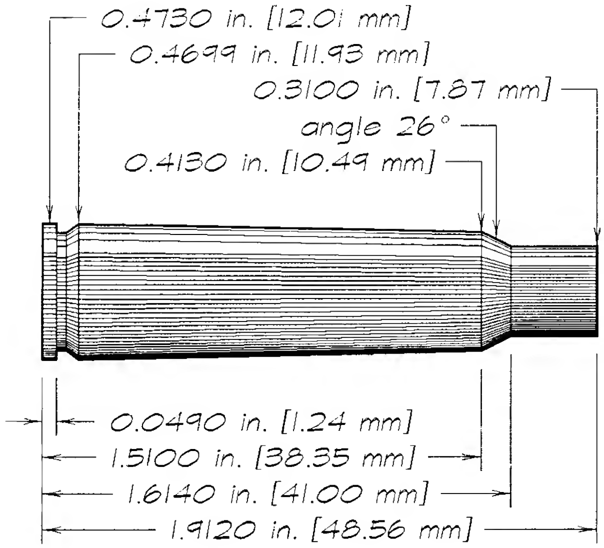
Form from .307 Winchester brass, in RCBS form-and-trim die. Ream neck, if necessary, in RCBS ream die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

7mm-.250 Davis Newton

(designer's specs)

solid:
584 gr brass
69 gr water



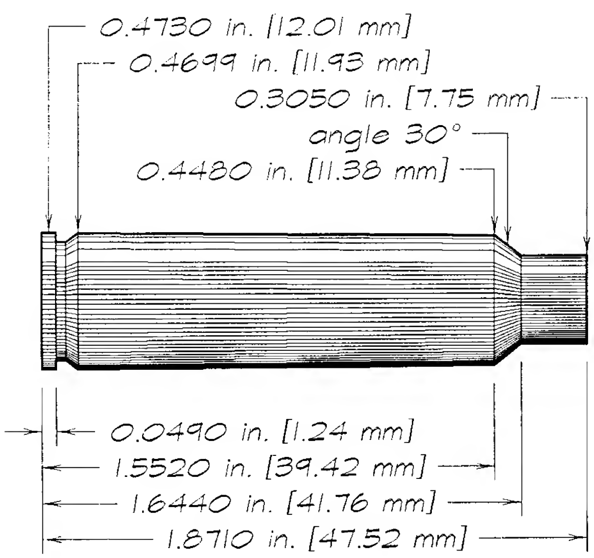
.284 bullet displaces
16.02 grains per inch.

Anneal neck of .250 Savage brass. Fire-form with inert filler.

7mm-.300 Davis Savage

(designer's specs)

solid:
611 gr brass
72 gr water



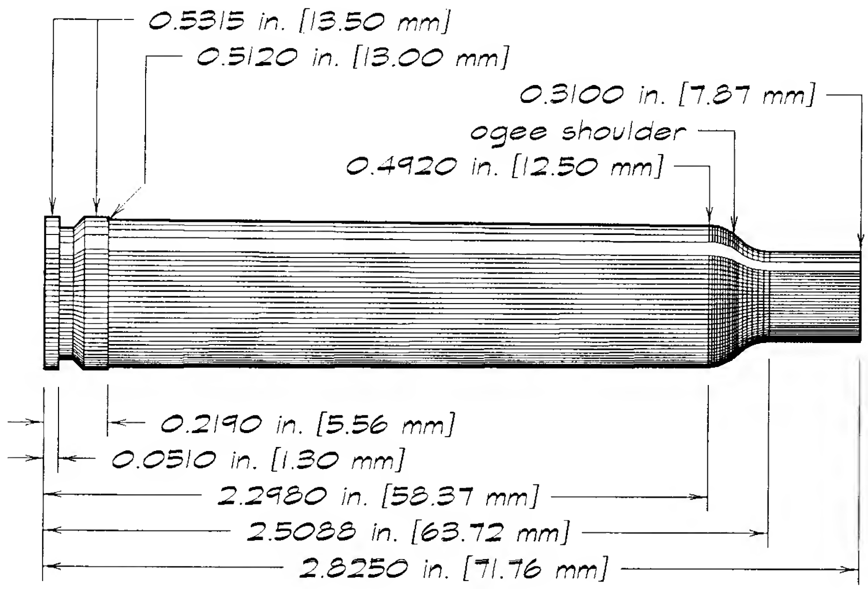
.284 bullet displaces
16.02 grains per inch.

Resize .300 Savage brass full-length in 7mm-.300 sizer die.

Anneal only by method shown in text.   Text explains use of "solid" and displacement figures.

7mm-.300 Weatherby Magnum (David J LeGate)

solid:
1,120 gr brass
131 gr water

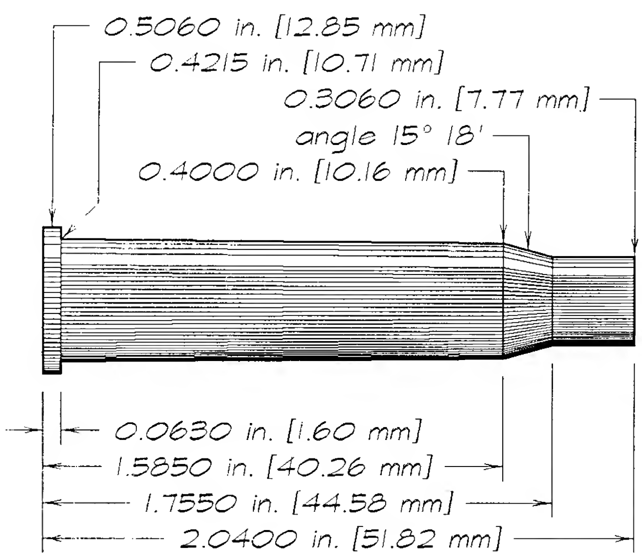


.284 bullet displaces
16.02 grains per inch.

Form from .300 Weatherby Magnum brass, in RCBS form and trim dies. Deburr.

7-30 Waters (Federal Ctg Co dwg)

solid:
543 gr brass
64 gr water



.284 bullet displaces
16.02 grains per inch.

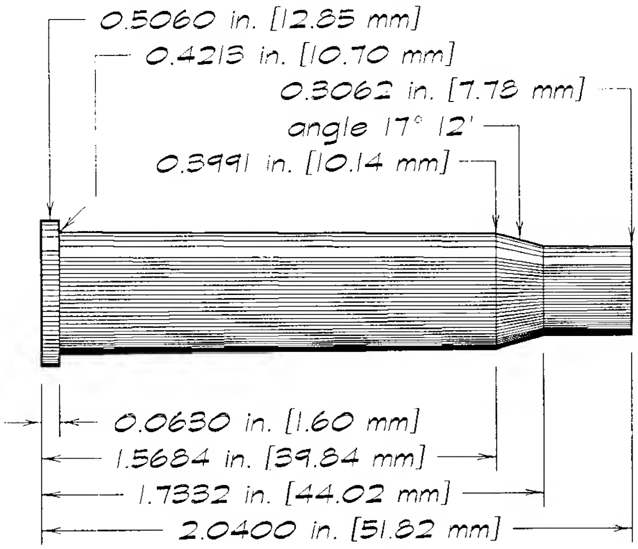
Use factory 7-30 Waters brass. Or resize .30-30 Winchester brass full-length in 7-30 Waters sizer die. Or fire-form .25-35 Winchester brass with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

7-30 Waters

(SAAMI maximums)

solid:
540 gr brass
63 gr water



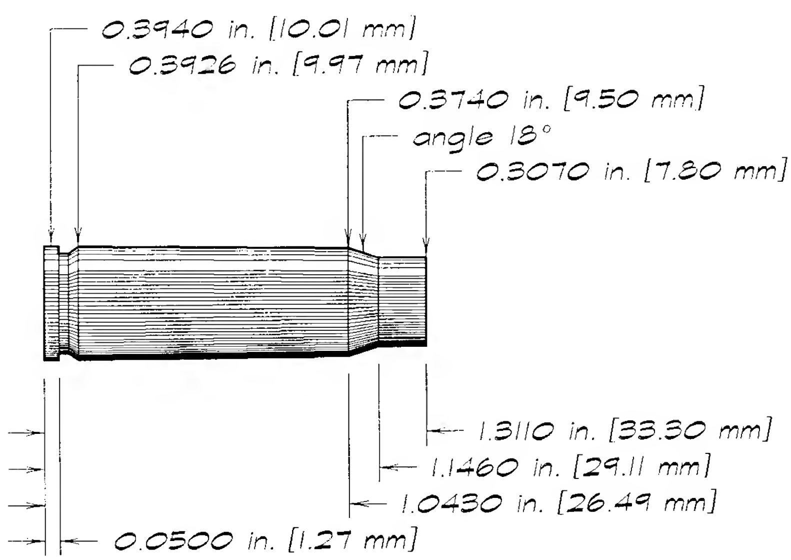
.284 bullet displaces 16.02 grains per inch.

Ken Waters' 7mm-.30-30 wildcat now has a SAAMI pedigree, so factory 7-30 Waters brass is available. Or form from .30-30 Winchester brass or any of its offspring (.25-35 Winchester, for example). Fire-form with inert filler to expand a case, or resize full-length in the 7-30 Waters sizer to neck it down.

7x33mm Sako

(unfired specimen)

solid:
307 gr brass
36 gr water



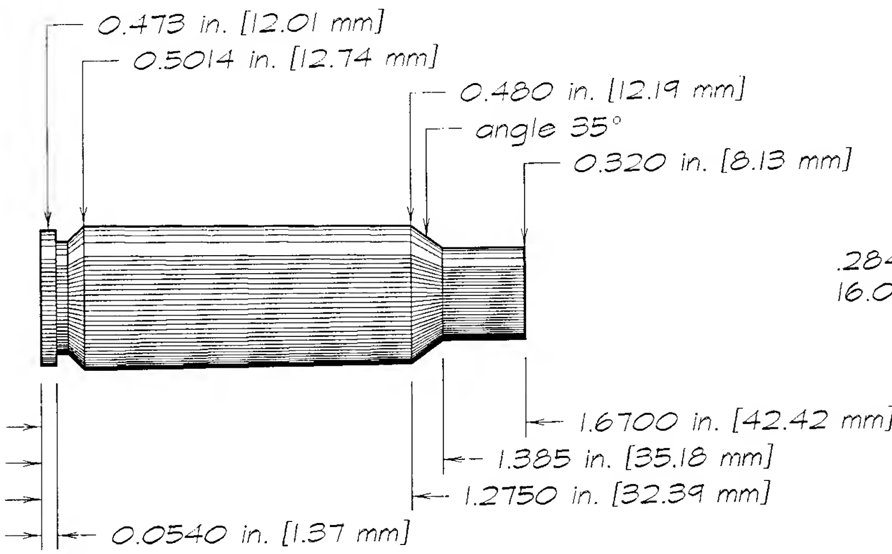
.285 bullet displaces 16.13 grains per inch.

Use factory 7x33mm brass.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

7x42mm (designer's specs)

solid:
587 gr brass
69 gr water

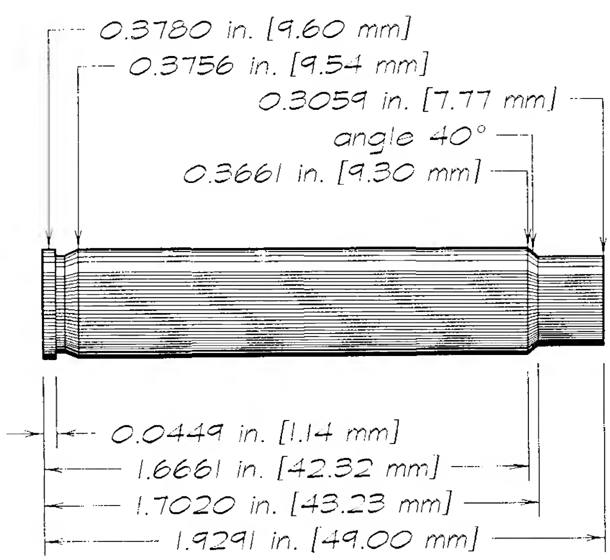


.284 bullet displaces 16.02 grains per inch.

Anneal neck, shoulder, and upper body of .284 Winchester brass and form in RCBS form dies.

7x49mm GJW (CIP maximums)

solid:
429 gr brass
50 gr water



.285 bullet displaces 16.13 grains per inch.

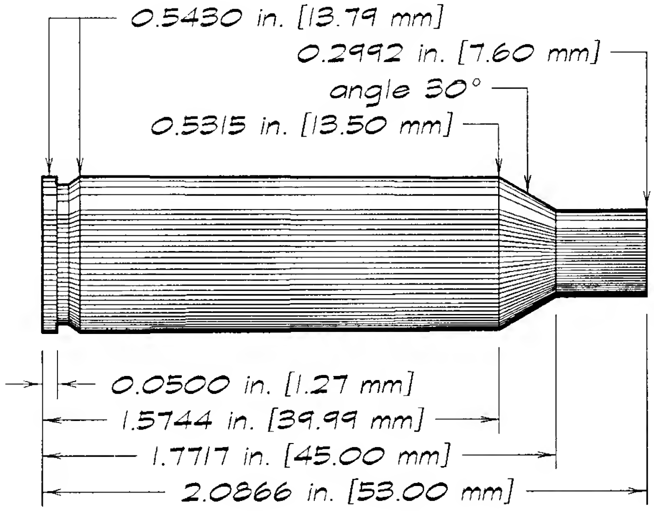
Use factory 7x49mm GJW brass. (Base is same as .222 Remington Magnum, but the .222 Remington Magnum case is too short.)

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

7x53mm NS

(designer's drawing)

solid:
868 gr brass
102 gr water



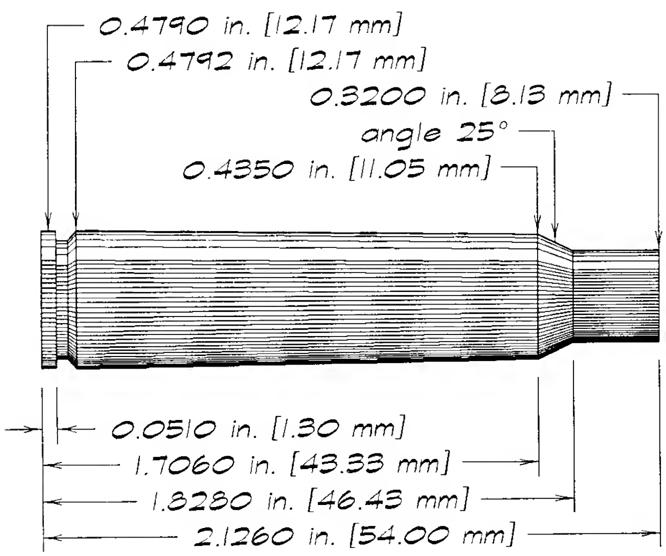
.284 bullet displaces
16.02 grains per inch.

Anneal neck and shoulder of .404 Jeffery brass. Form and trim, in RCBS form-and-trim die. Ream inside neck, in RCBS neck-ream die.

7x54mm (Finland)

(unfired specimen)

solid:
691 gr brass
81 gr water



.285 bullet displaces
16.13 grains per inch.

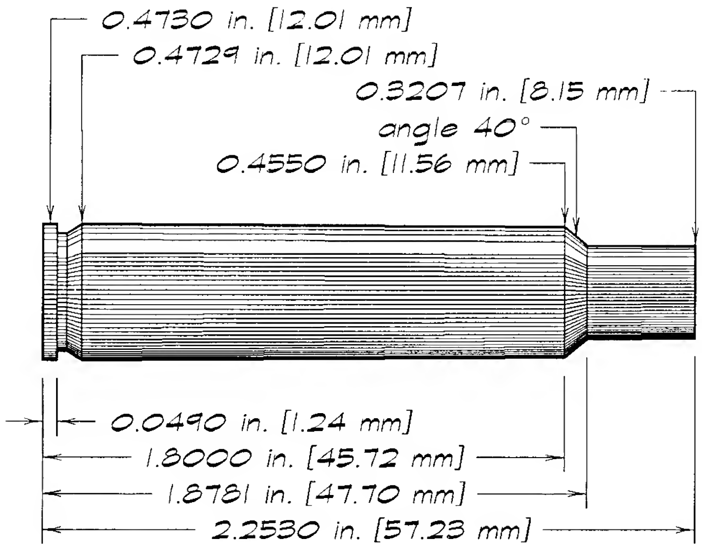
Resize 6.5x55mm Swedish Mauser brass full-length in 7x54mm sizer die. Trim to 2.125 inch and deburr.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

7x57mm Ackley Improved

(Speer manual number 4)

solid:
671 gr brass
79 gr water



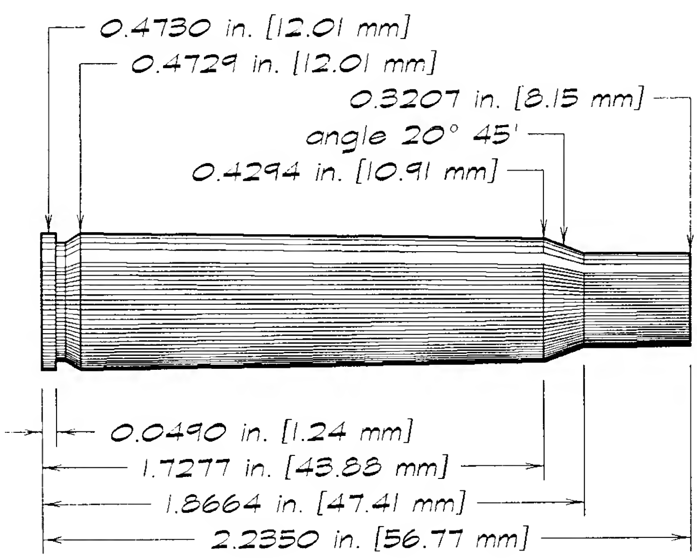
.284 bullet displaces
16.02 grains per inch.

Fire-form 7x57mm Mauser brass with inert filler. Or fire 7x57mm Mauser ammunition in "improved" chamber.

7x57mm Mauser (7mm Mauser)

(SAAMI maximums.)

solid:
699 gr brass
82 gr water



.284 bullet displaces
16.02 grains per inch.

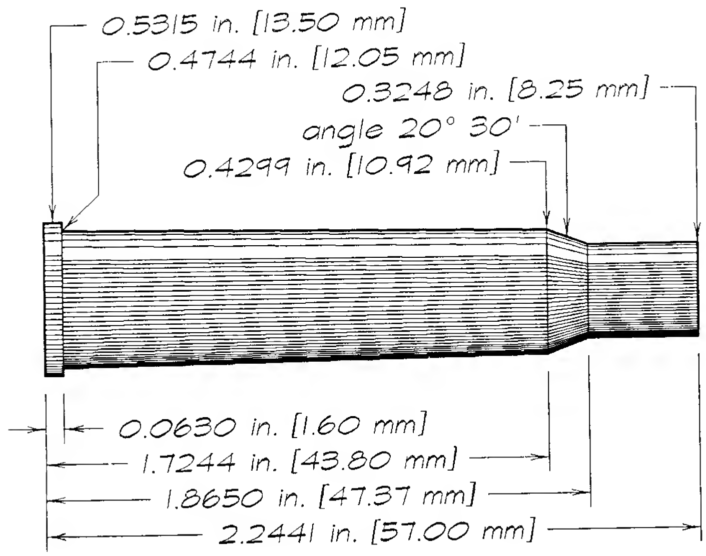
Use recently manufactured Boxer-primed cases. Or form from .30-06 Springfield or 7.7x58mm Arisaka brass, in respective RCBS form die. Or resize 8x57mm Mauser cases full-length in 7x57mm Mauser sizer die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

7x57mm Rimmed

(CIP maximums)

solid:
707 gr brass
83 gr water



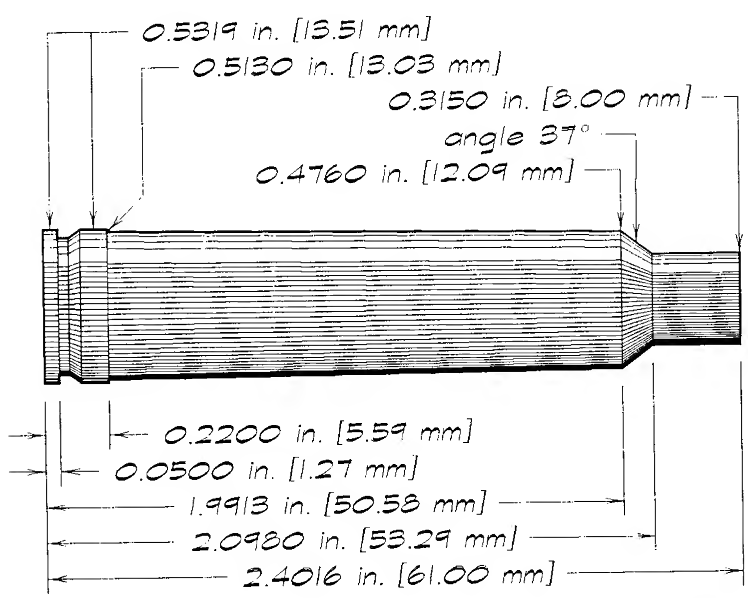
.285 bullet displaces 16.13 grains per inch.

Use factory 7x57mm Rimmed brass. Or form from 8x57mm Rimmed brass, in RCBS form-and-trim die.

7x61mm Super Norma (7x61mm Sharpe & Hart)

(Triebel maximums)

solid:
946 gr brass
111 gr water



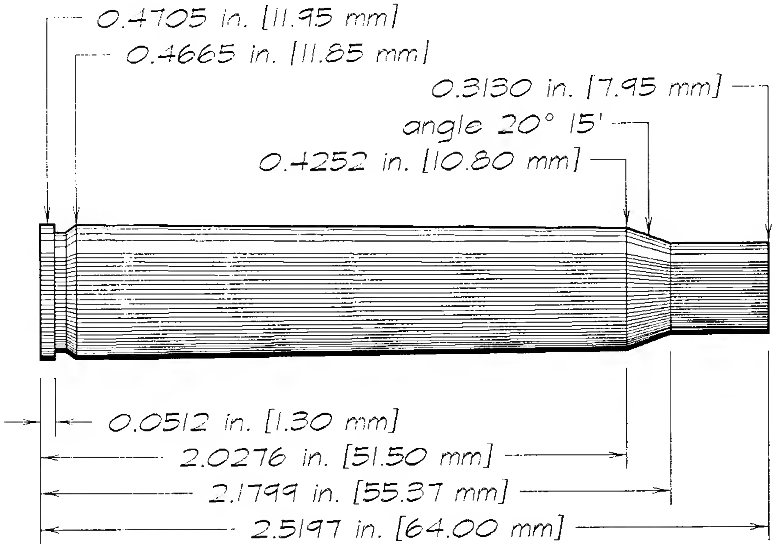
.285 bullet displaces 16.13 grains per inch.

Use factory 7x61mm brass. Or form from 7mm Remington Magnum, .300 or .338 Winchester Magnum, or .300 H&H Magnum brass, in respective RCBS form-and-trim dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

7x64mm

(CIP maximums)



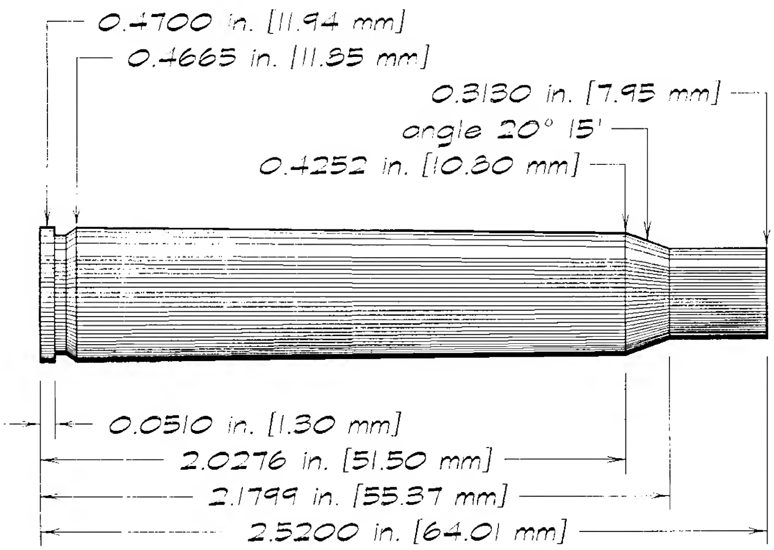
solid:
788 gr brass
92 gr water

.285 bullet displaces 16.13 grains per inch.

Use 7x64mm Brenneke brass. Or fire-form .25-06 Remington or .270 Winchester brass with inert filler. Or resize .35 Whelen brass full-length in 7x64mm sizer die.

7x64mm Brenneke

(RCBS drawing)



solid:
787 gr brass
92 gr water

.285 bullet displaces 16.13 grains per inch.

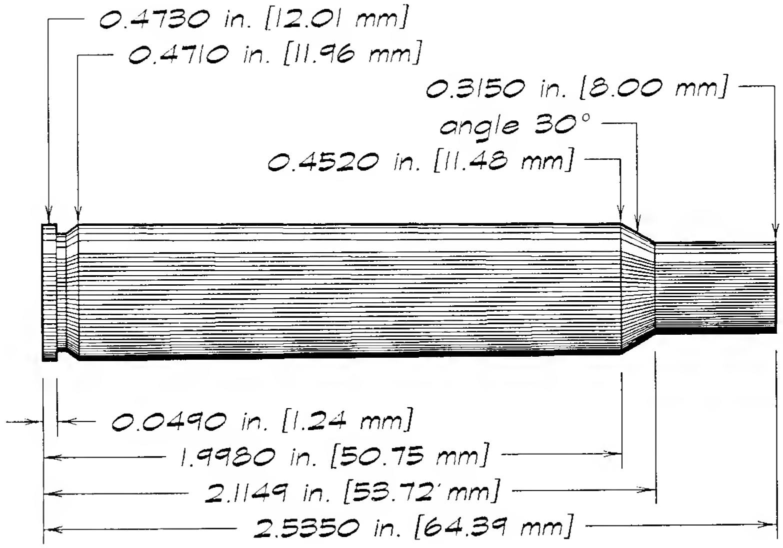
Use factory 7x64mm Brenneke brass. Or fire-form .25-06 Remington or .270 Winchester brass with inert filler. Or resize .35 Whelen brass full-length in 7x64mm Brenneke sizer die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

7x64mm Improved

(Speer manual number 4)

solid:
809 gr brass
95 gr water



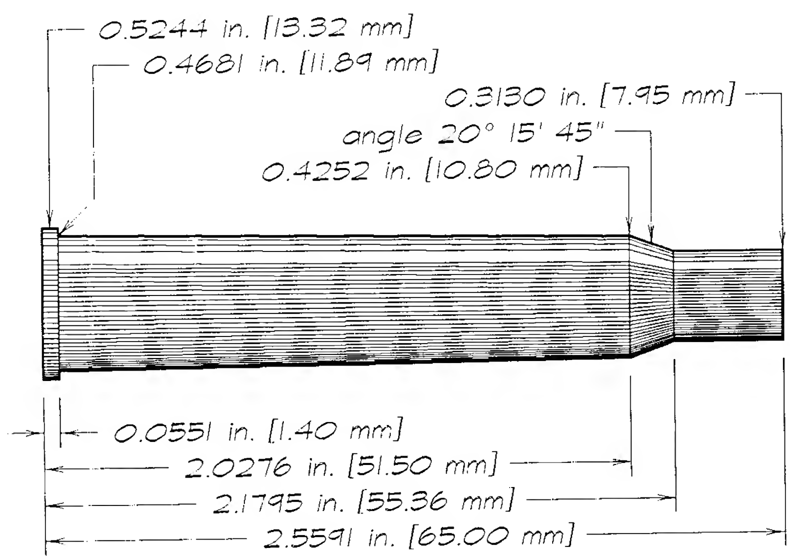
..284 bullet replaces
16.02 grains per inch.

Fire-form .270 Winchester or .280 Remington brass with inert filler.

7x65mm Rimmed

(CIP maximums)

solid:
791 gr brass
93 gr water



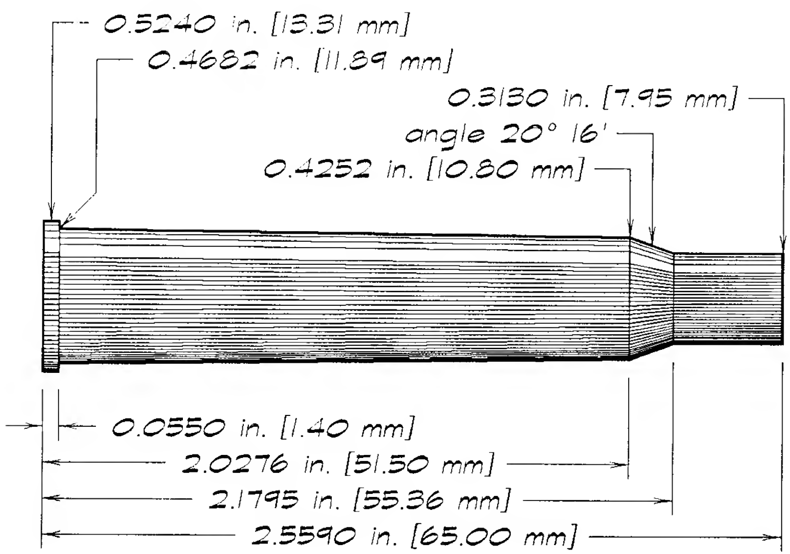
.285 bullet displaces
16.13 grains per inch.

Use factory 7x65R brass. Or form from .405 Basic, 9.3x74mm Rimmed, or 9.3x74R Basic brass, in RCBS form amd trim dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

7x65mm Rimmed (Brenneke) (RCBS drawing)

solid:
792 gr brass
93 gr water

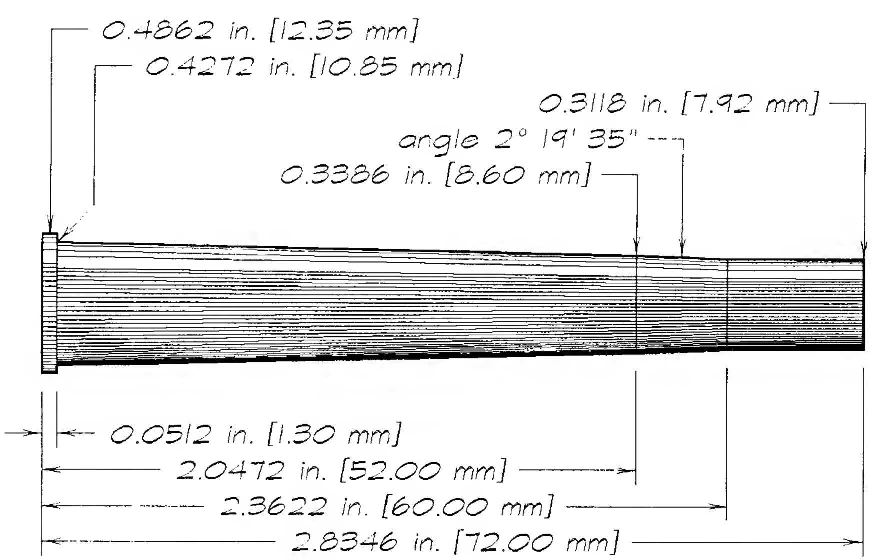


.285 bullet displaces
16.13 grains per inch.

Use factory 7x65R brass. Or form from .405 Basic, 9.3x74mm Rimmed, or 9.3x74R Basic brass, in RCBS form and trim dies.

7x72mm Rimmed (CIP maximums)

solid:
645 gr brass
76 gr water



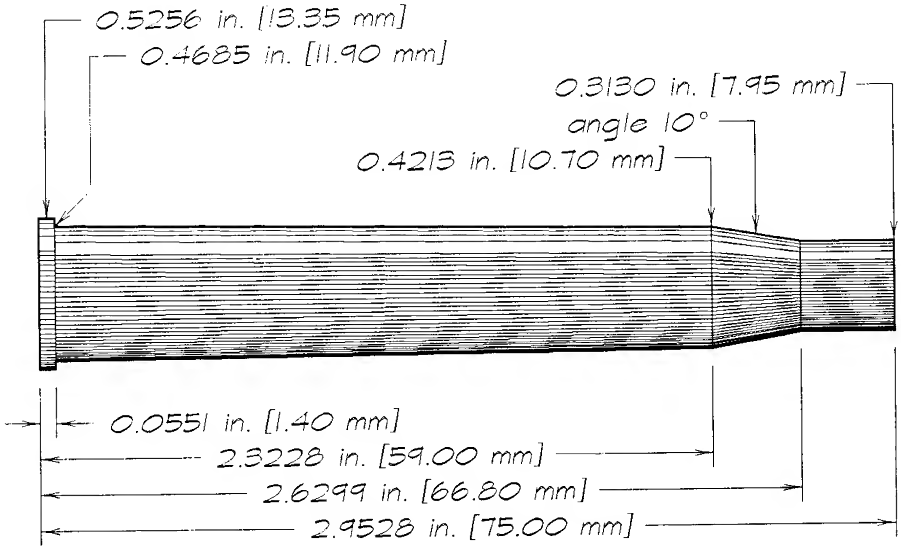
.285 bullet displaces
16.13 grains per inch.

Use recently manufactured 7x72mm Rimmed brass. Or form from 9.3x72mm Rimmed brass, in RCBS form dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

7x75mm Rimmed Super Express vom Hofe (CIP maximums)

solid:
911 gr brass
107 gr water

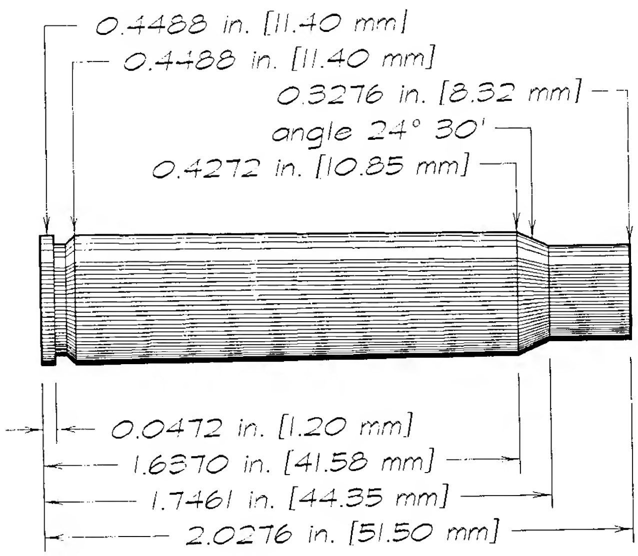


.285 bullet displaces 16.13 grains per inch.

Use factory 7x75mm RSE brass, or form from .405 Basic brass in RCBS form dies.

7.35x52mm Carcano (Triebel maximums)

solid:
608 gr brass
71 gr water



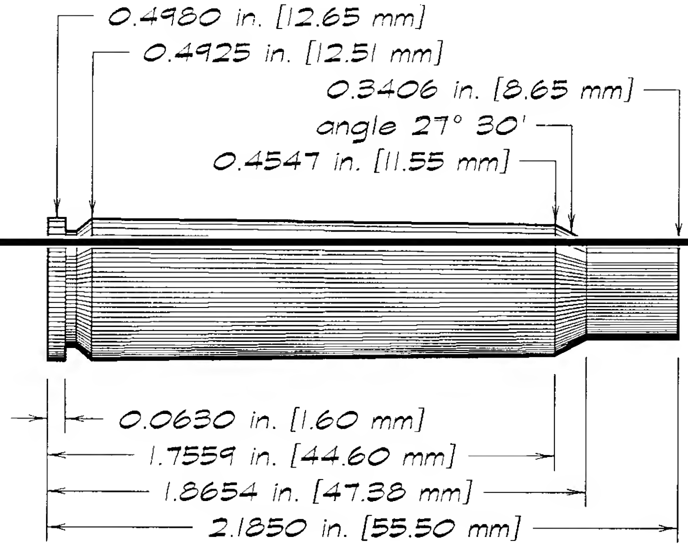
.298 bullet displaces 17.64 grains per inch.

Form from 6.5x54mm Mannlicher Schoenauer or 6.5mm Carcano brass, in RCBS form-and-trim die. Fire-form with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

7.5mm Schmidt-Rubin (7.5x55mm) (RCBS drawing)

solid:
765 gr brass
90 gr water

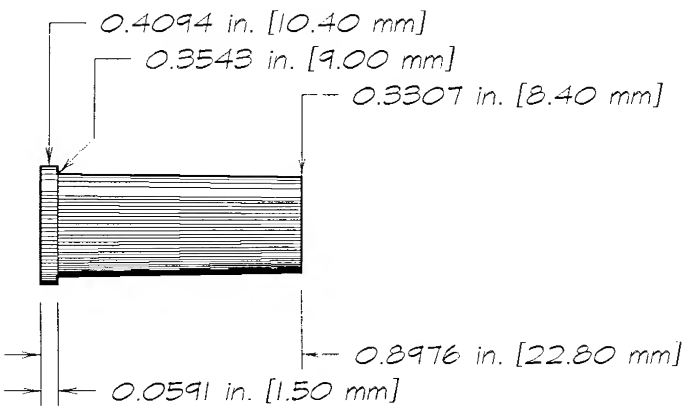


.307 bullet displaces
18.72 grains per inch.

Fire-form .284 Winchester case with inert filler. Trim. Deburr.

7.5mm Swiss Ordnance (CIP maximums)

solid:
181 gr brass
21 gr water



.315 bullet displaces
19.71 grains per inch.

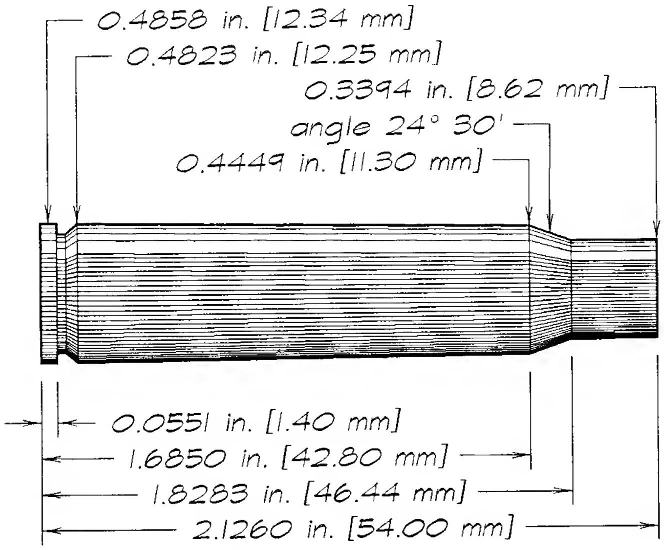
Use factory 7.5mm OS brass. Or trim .32-20 Winchester brass to 0.895 inch long and deburr. Ream inside neck, if necessary, in RCBS neck-ream die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

7.5x54mm MAS

(Triebel maximums)

solid:
719 gr brass
84 gr water



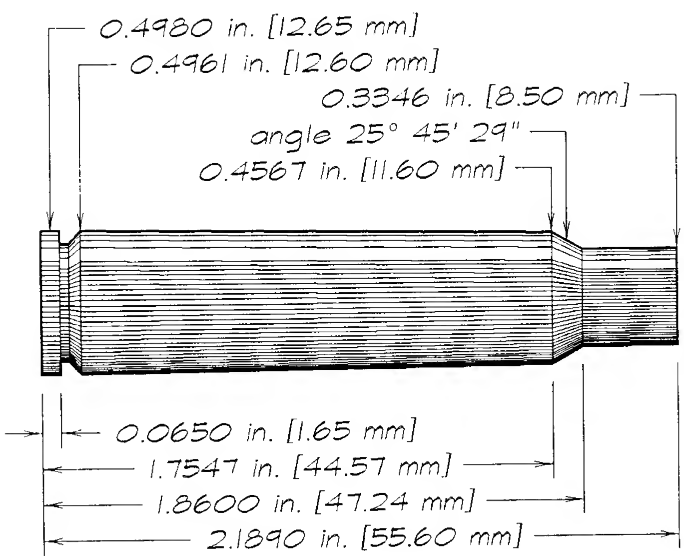
.308 bullet displaces
18.84 grains per inch.

Form from .284 Winchester brass, in special RCBS base-form die (in arbor press) and form-and-trim die. Deburr.

7.5x55mm GPII

(CIP maximums)

solid:
767 gr brass
90 gr water



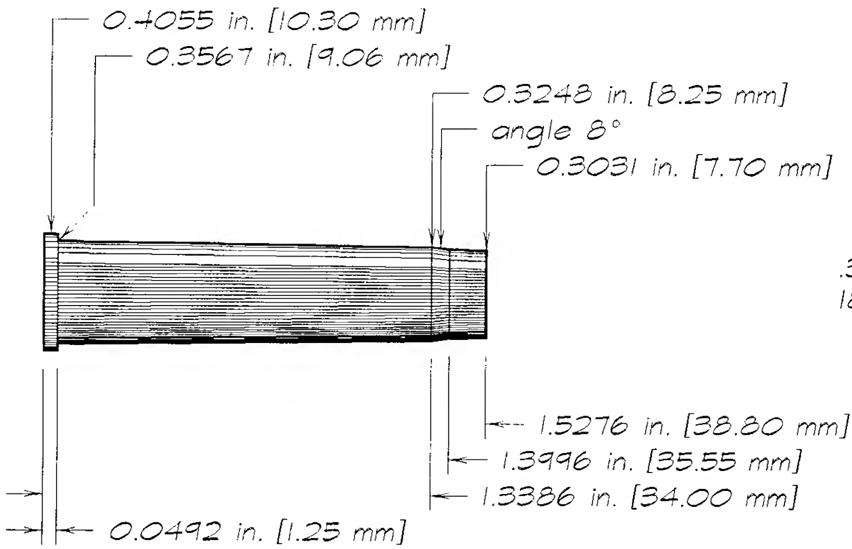
.304 bullet displaces
18.36 grains per inch.

Use the virtually identical 7.5x55mm Schmidt Rubin brass. Or fire-form .284 Winchester brass with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

7.62mm Nagant (Russian)

(CIP maximums)



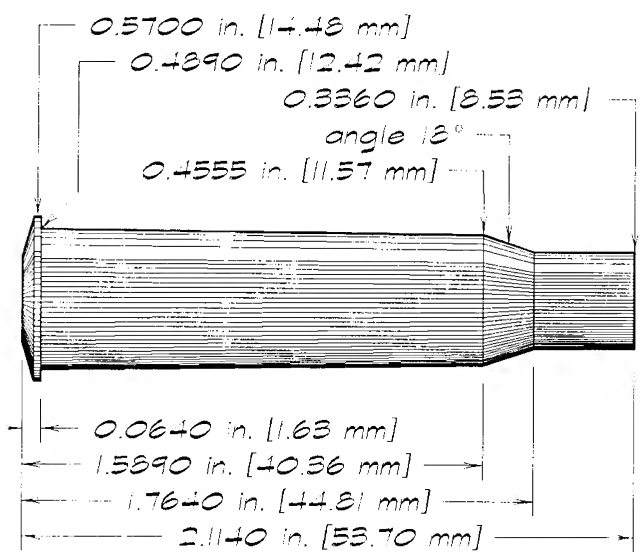
solid:
300 gr brass
35 gr water

.308 bullet displaces
18.84 grains per inch.

Use recently manufactured 7.62mm Nagant brass. Or resize .32-20 Winchester brass full-length in body of 7.62mm Nagant sizer die (without decapper-expander assembly) and fire-form with inert filler.

7.62mm Russian (7.62x54mm Rimmed)

(SAAMI maximums, 1965)



solid:
702 gr brass
82 gr water

.310 bullet displaces
19.09 grains per inch.

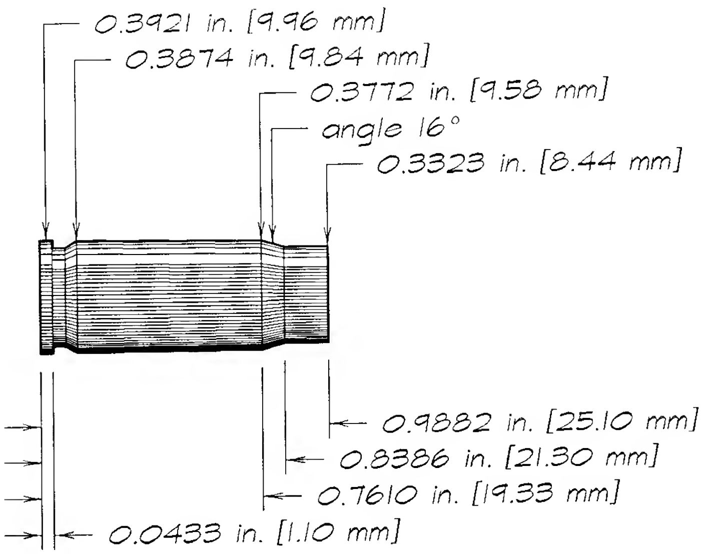
Turn rim of .45-70 Springfield to 0.570 inch diameter and thin to 0.064 inch, if necessary. Anneal case from mouth back about 3/4 inch, then size full-length in sizing die. Trim to 2.05 inches and deburr mouth.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

7.62mm Tokarev (7.62x25mm)

(Triebel maximums)

solid:
231 gr brass
27 gr water



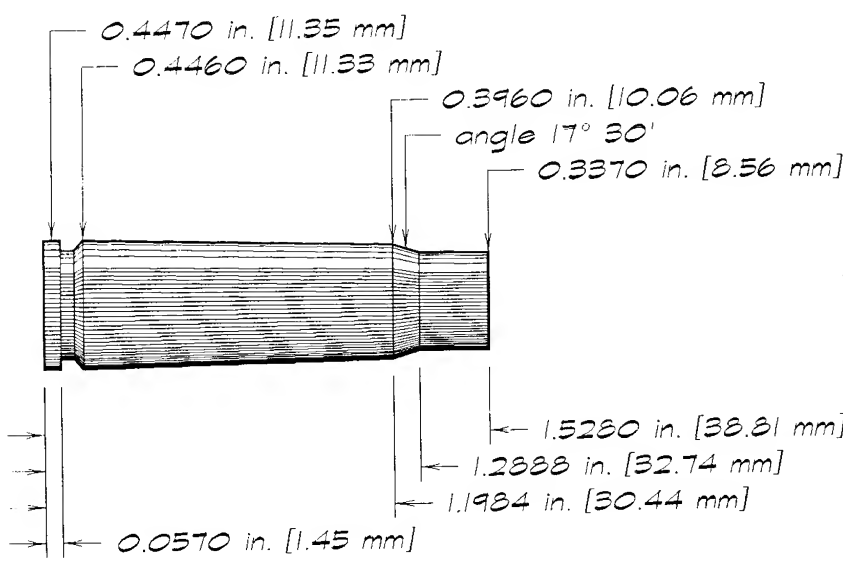
.308 bullet displaces
18.84 grains per inch.

Resize 9mm Winchester Magnum brass full-length in 7.62mm Tokarev sizer die. Trim and deburr. Or anneal shoulder and upper body of .222 or .223 Remington brass and form in RCBS form, trim, and ream dies and deburr.

7.62x39mm

(SAAMI maximums)

solid:
439 gr brass
51 gr water



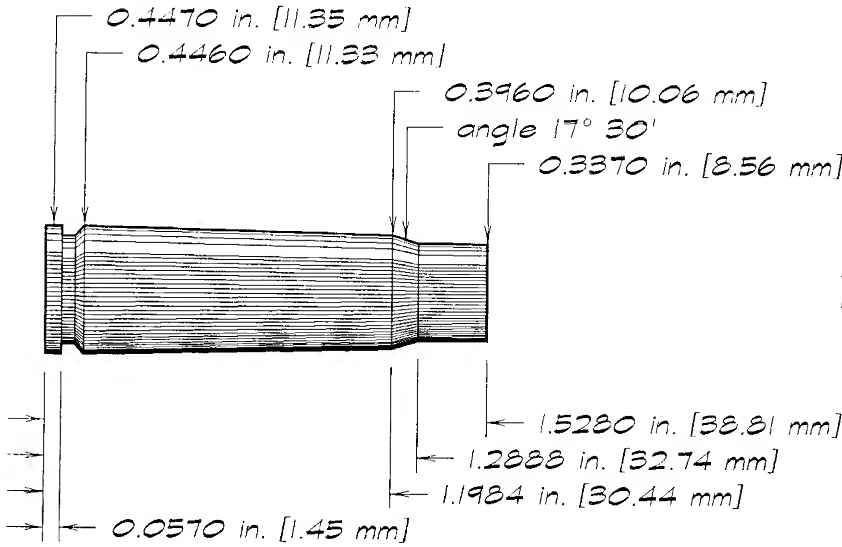
.311 bullet displaces
19.21 grains per inch.

Form from 6.5x54mm Mannlicher Schoenauer, 6.5x52mm Carcano, 7.35x51mm Carcano, 7.35mm Terni, .220 Swift, .308 Winchester, or .30-06 brass, in special RCBS base-form die (in arbor press) and form, trim, and ream dies. Deburr. Use only reduced loads in cases formed from .308 Winchester brass.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

7.62x39mm

(SAAMI maximums)



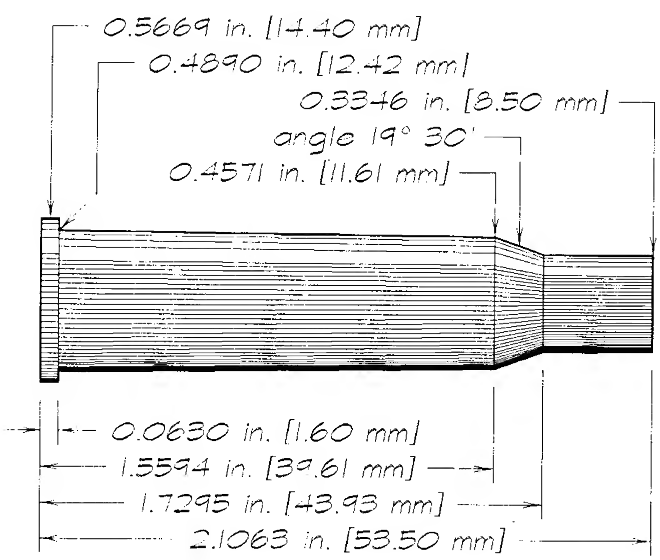
solid:
439 gr brass
51 gr water

.311 bullet displaces
19.21 grains per inch.

Form from 6.5x54mm Mannlicher Schoenauer, 6.5x52mm Carcano, 7.35x51mm Carcano, 7.35mm Terni, .220 Swift, .308 Winchester, or .30-06 brass, in special RCBS base-form die (in arbor press) and form, trim, and ream dies. Deburr. Use only reduced loads in cases formed from .308 Winchester brass.

7.62x54mm Rimmed

(CIP maximums)



solid:
702 gr brass
82 gr water

.310 bullet displaces
19.09 grains per inch.

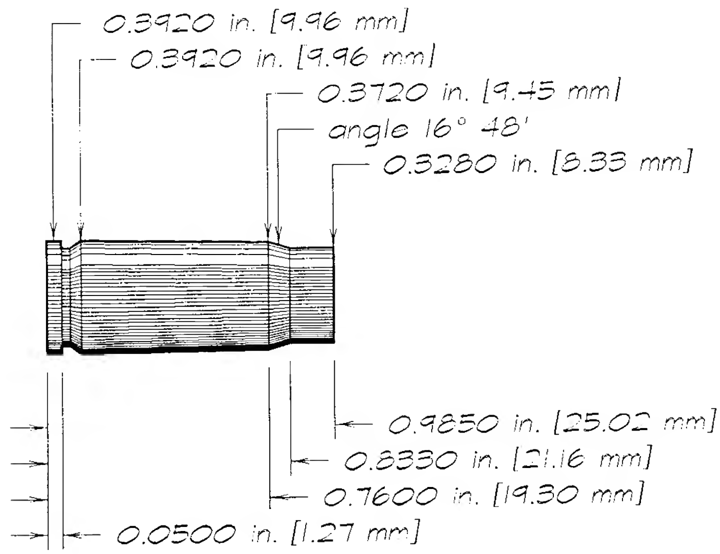
Use factory 7.62x54mm Rimmed brass. Or use the virtually identical 7.62x53mm Rimmed brass.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

7.63mm Mauser (.30 Mauser) Pistol

(ICI Metals Ltd dwg)

solid:
230 gr brass
27 gr water



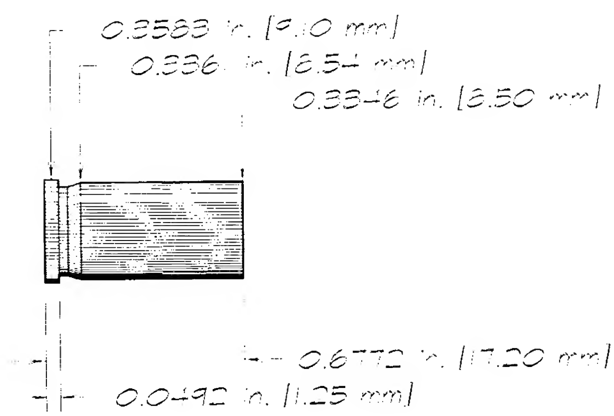
.308 bullet displaces
18.84 grains per inch.

Use factory .30 Mauser brass. Or anneal neck, shoulder, and upper body of .222 or .223 Remington brass, then form and trim in RCBS form and trim dies. Deburr.

7.65mm Browning

(Triebel maximums)

solid:
134 gr brass
16 gr water

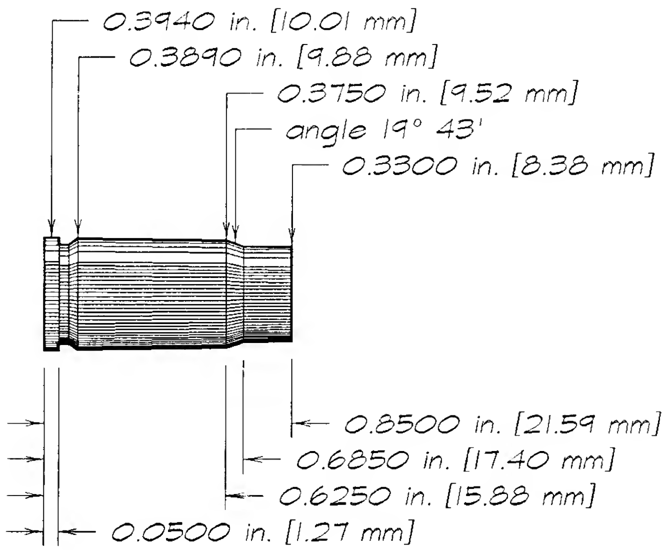


.308 bullet displaces
18.84 grains per inch.

Use the essentially identical .32 Automatic brass.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

7.65mm Parabellum (.30 Luger) (ICI Metals Ltd dwg)

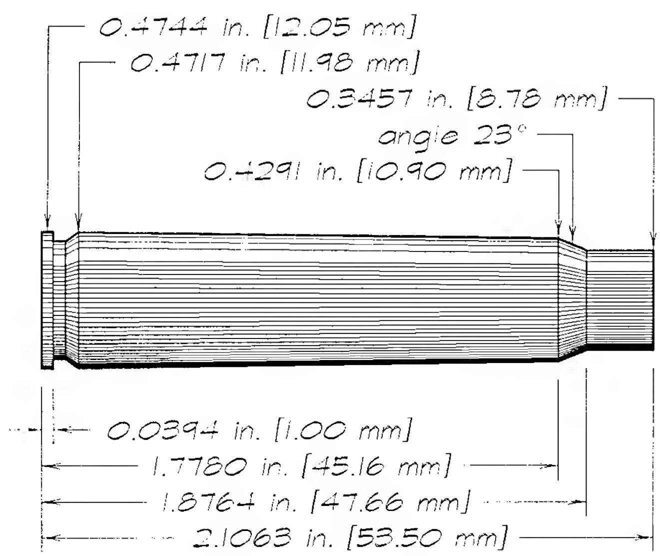


solid:
197 gr brass
23 gr water

.308 bullet displaces
18.84 grains per inch.

Use factory brass (7.65mm Parabellum or .30 Luger). Or form from 9mm Winchester Magnum brass. Trim to 0.85 inch and deburr.

7.65x53mm Argentine (CIP maximums)



solid:
700 gr brass
82 gr water

.313 bullet displaces
19.46 grains per inch.

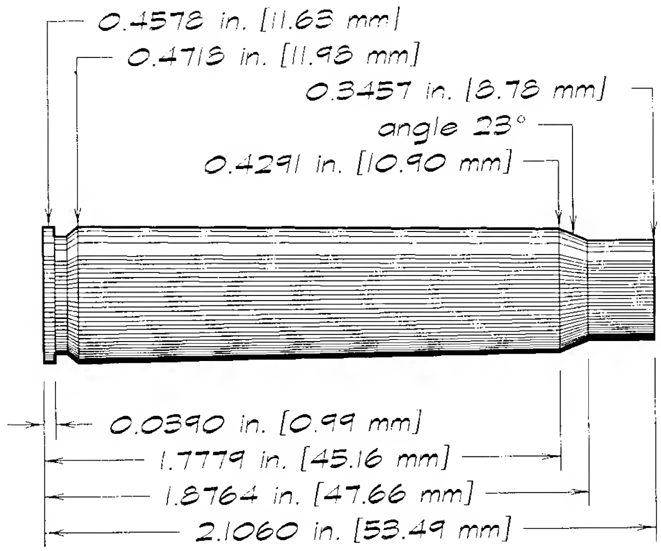
Use factory 7.65x53mm brass. Or anneal neck and shoulder of .30-06 Springfield brass, trim to 2.1 inches, deburr, and size full-length in body of 7.65x53mm sizer die. Fire-form with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

7.65x53mm Mauser (Belgian)

(RCBS drawing)

solid:
699 gr brass
82 gr water



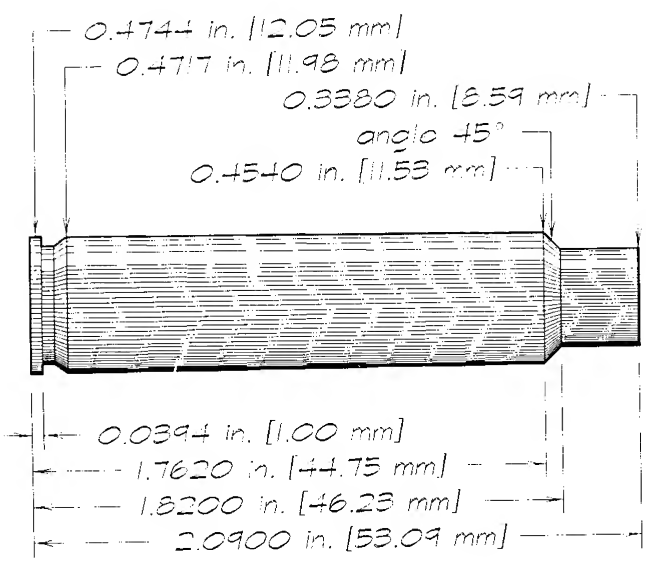
.312 bullet displaces
19.33 grains per inch.

Form from .30-06 Springfield brass, in RCBS form-and-trim die.

7.65x53mm Davis Improved

(designer's specs)

solid:
705 gr brass
83 gr water



.311 bullet displaces
19.21 grains per inch.

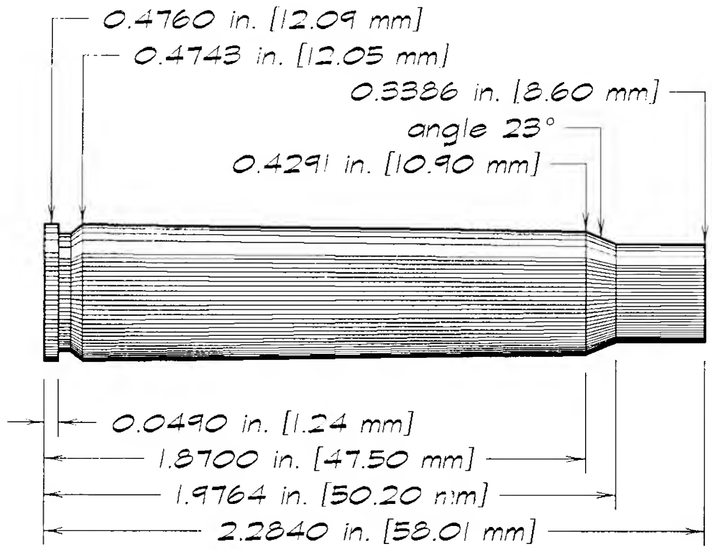
Fire-form 7.65x53mm Argentine brass with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

7.7x58mm (Japanese)

(RCBS drawing)

solid:
752 gr brass
88 gr water



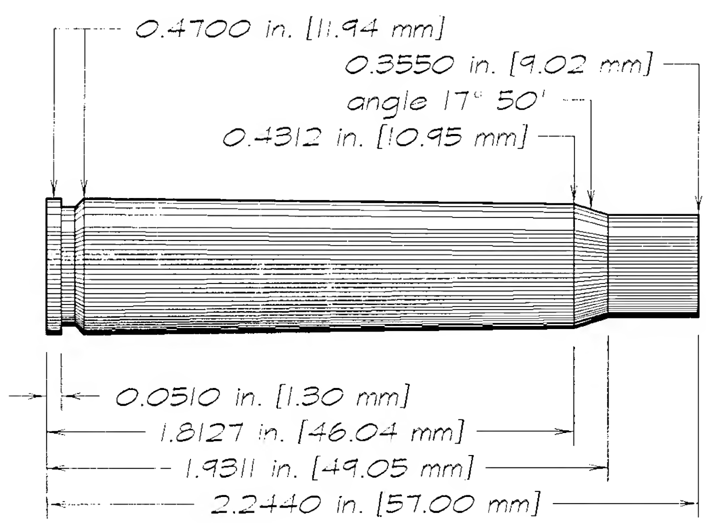
.311 bullet displaces
19.21 grains per inch.

Form from any .30-06-based case that's long enough, in RCBS form die.

7.9mm Mauser

(ICI Metals Ltd dwg)

solid:
736 gr brass
86 gr water



.319 bullet displaces
20.21 grains per inch.

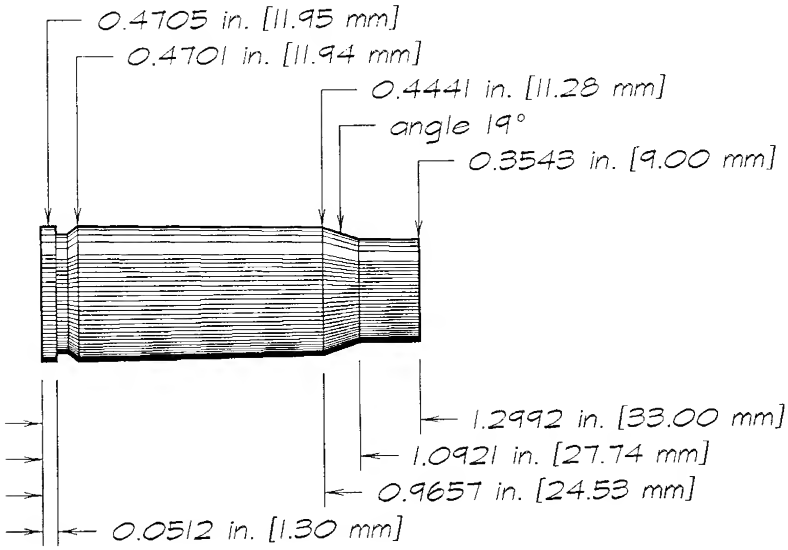
Use the essentially identical 8x57mm Mauser brass.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

7.92x33mm Kurz

(CIP maximums)

solid:
424 gr brass
50 gr water



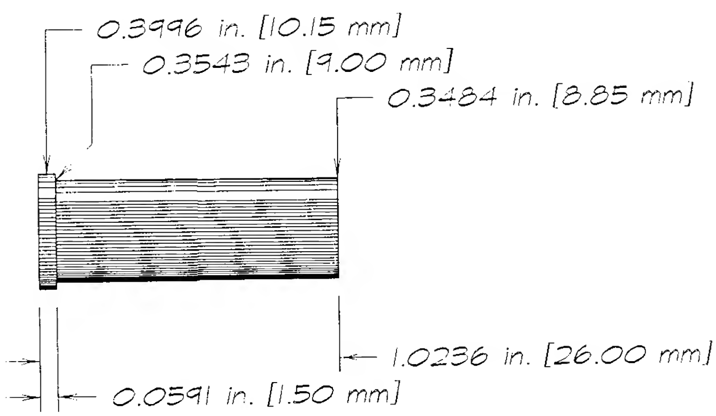
.320 bullet displaces
20.34 grains per inch.

Use factory 7.92x33mm Kurz brass. Or anneal shoulder and upper body of .308 Winchester or 8mm Mauser brass and form in RCBS form, trim, and ream dies.

8mm French Ordnance NR

(Triebel maximums)

solid:
229 gr brass
27 gr water



.326 bullet displaces
21.11 grains per inch.

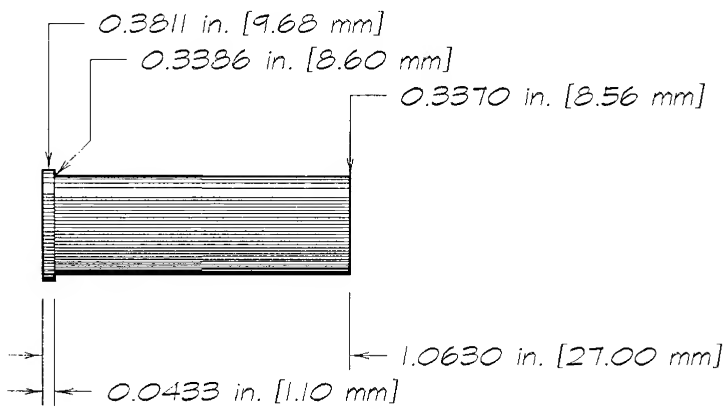
Trim .32-20 Winchester brass to 1.02 inch and deburr. Turn and thin rim if necessary. Fire-form with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

8mm Gasser

(CIP maximums)

solid:
220 gr brass
26 gr water



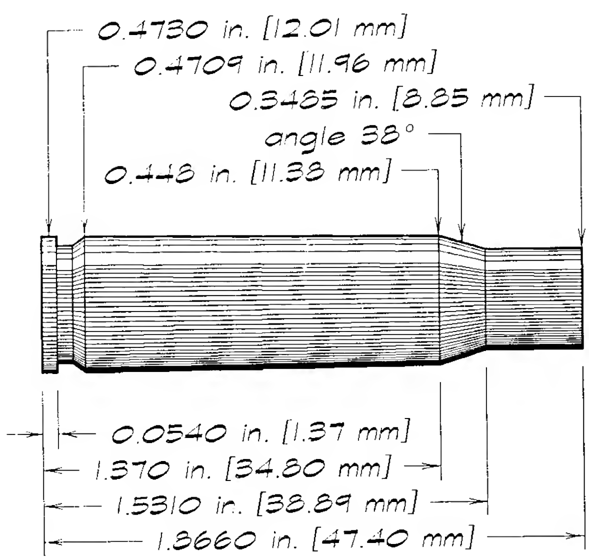
.319 bullet displaces
20.21 grains per inch.

Use factory 8mm Gasser brass. Or trim .32 H&R magnum brass to 1.06 inch (and thin rim, if necessary).

8mm IHMSA International

(David J LeGate)

solid:
603 gr brass
71 gr water



.324 bullet displaces
20.85 grains per inch.

Use factory IMHSA brass. Or resize .300 Savage brass full-length in 8mm IHMSA sizer die. Or resize .308 Winchester brass full-length in 8mm IHMSA sizer die, trim to length, and deburr.

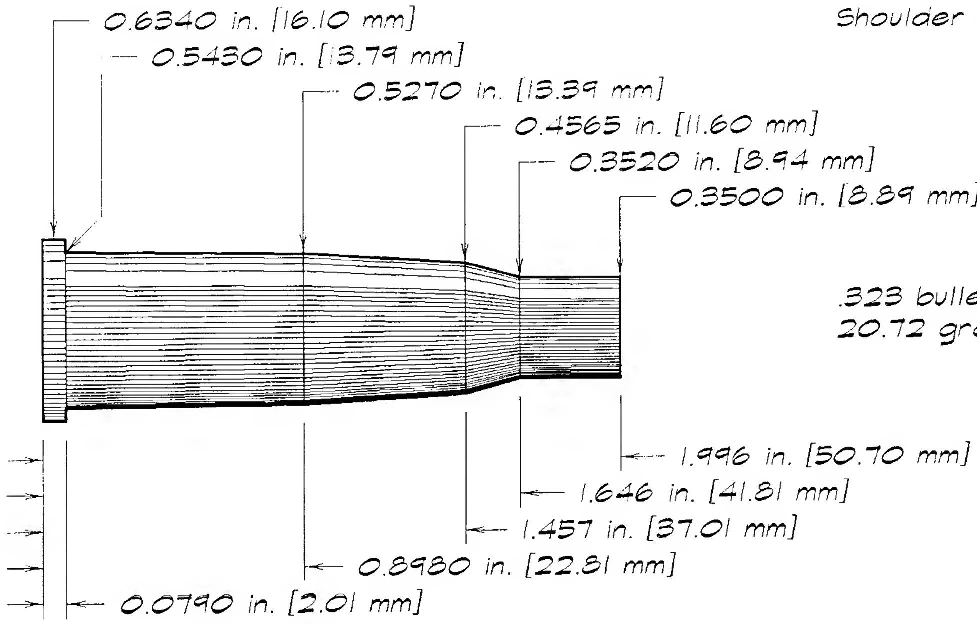
Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

8mm Lebel (8x50mm Rimmed)

(SAAMI maximums, 1938)

Shoulder angle: 17° 30'

solid:
790 gr brass
93 gr water



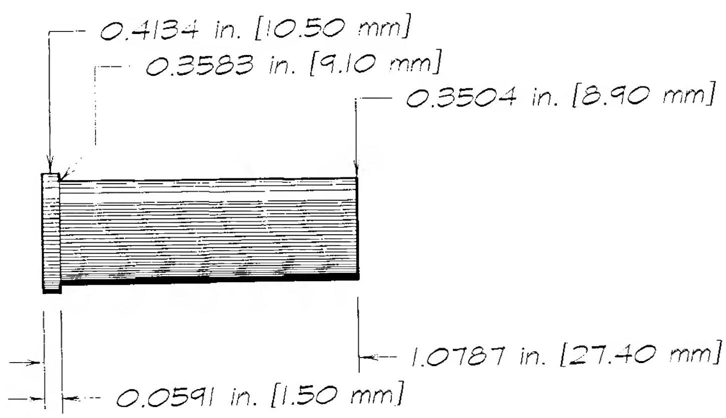
.323 bullet displaces
20.72 grains per inch.

Form from .348 Winchester brass, in RCBS form-and-trim die.

8mm Lebel [handgun]

(CIP maximums)

solid:
233 gr brass
27 gr water



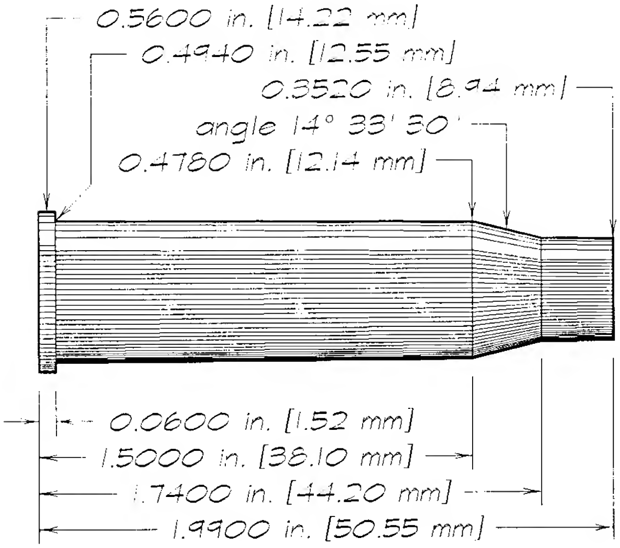
.326 bullet displaces
21.11 grains per inch.

Use factory 8mm Lebel handgun brass. Or fire-form .32-20 Winchester brass with inert filler, trim to 1.07 inch, and deburr.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

8mm Mannlicher

(ICI Metals Ltd dwg)

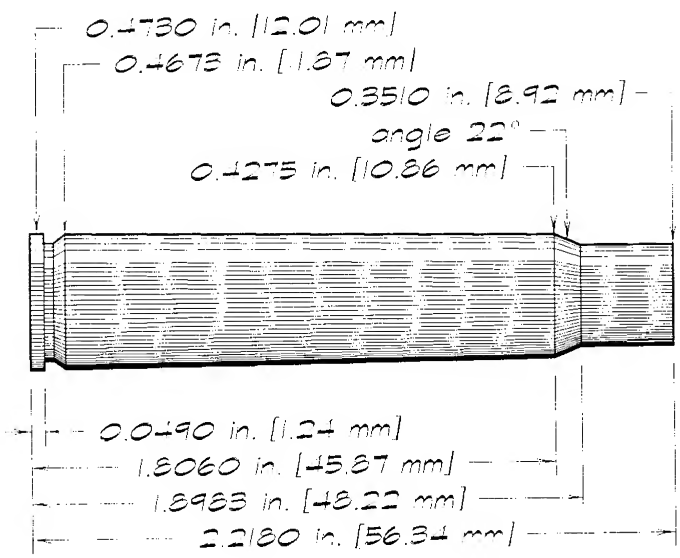


solid:
748 gr brass
88 gr water

.323 bullet displaces
20.72 grains per inch.

8mm Mannlicher-Schoenauer (8x56mm)

(SAAMI maximums, 1956)



solid:
728 gr brass
85 gr water

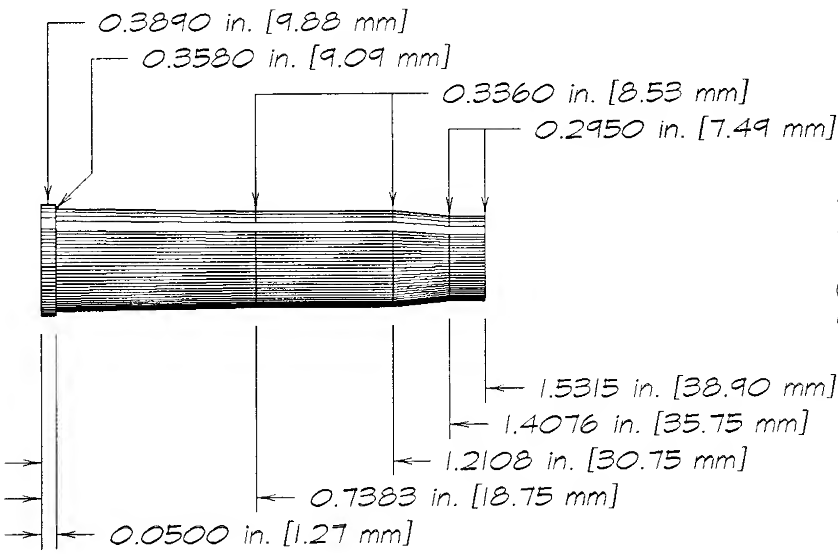
.323 bullet displaces
20.72 grains per inch.

Form from 8x57mm Mauser brass, in RCBS form die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

8mm Nagant Revolver (Czech dwgs, 1942-1952)

solid:
306 gr brass
36 gr water

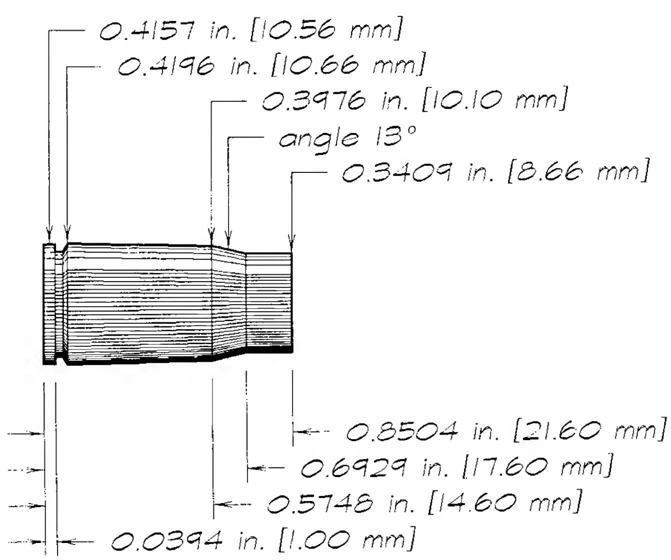


.307 bullet, seated deep inside case, displaces 18.72 grains per inch. (Bullet nose is about 0.05 in. below mouth.)

This isn't a necked case but a straight case with a long and funny "crimp." What appears to be a shoulder is a section of the case squeezed down over the ogive of the bullet. Compare this case with the 7mm Russian Nagant.

8mm Nambu (Sadamitsu Taguchi)

solid:
222 gr brass
26 gr water



.320 bullet displaces 20.34 grains per inch.

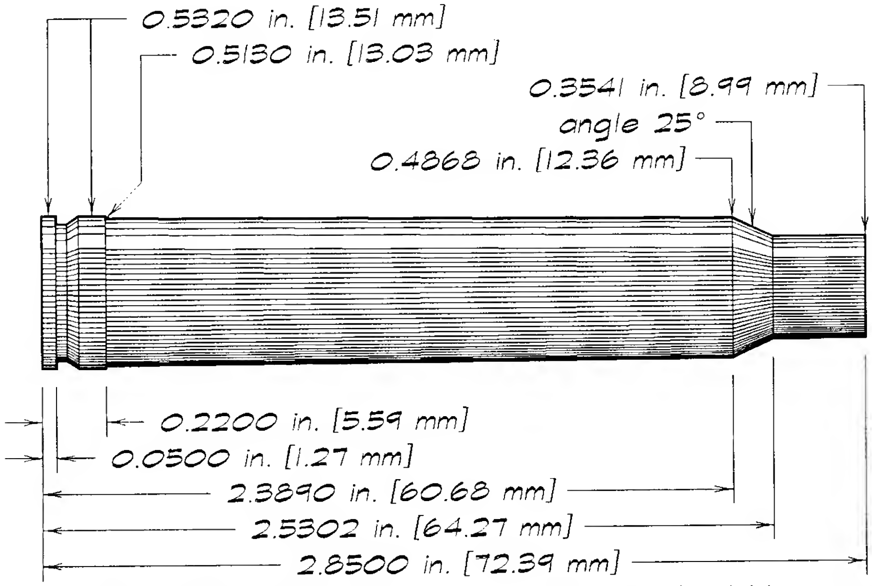
Use recently manufactured 8mm Nambu brass. Or resize .40 S&W brass full-length in 8mm Nambu sizer die. Or anneal neck, shoulder, and upper body of .30 Remington brass and form in RCBS form, trim, and ream dies. Deburr. Fire-form with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

8mm Remington Magnum

(SAAMI maximums)

solid:
1,158 gr brass
136 gr water



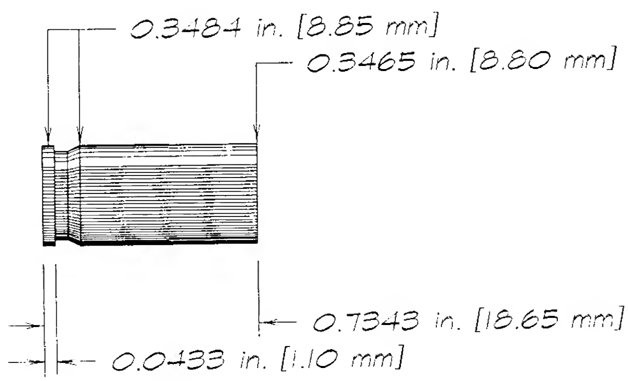
.323 bullet displaces
20.72 grains per inch.

Factory 8mm Remington brass is current and should be easy to find. Any H&H-Magnum-based case that's long enough can become an 8mm Remington Magnum. Fire-form .300 H&H magnum case with inert filler, or resize .375 H&H Magnum full-length in 8mm Remington Magnum sizer die. (.300 and .338 Winchester are too short. So are 7mm Magnum, .308 and .358 Norma, 6.5mm Remington, etc.)

8mm Steyr

(CIP maximums)

solid:
145 gr brass
17 gr water



.321 bullet displaces
20.47 grains per inch.

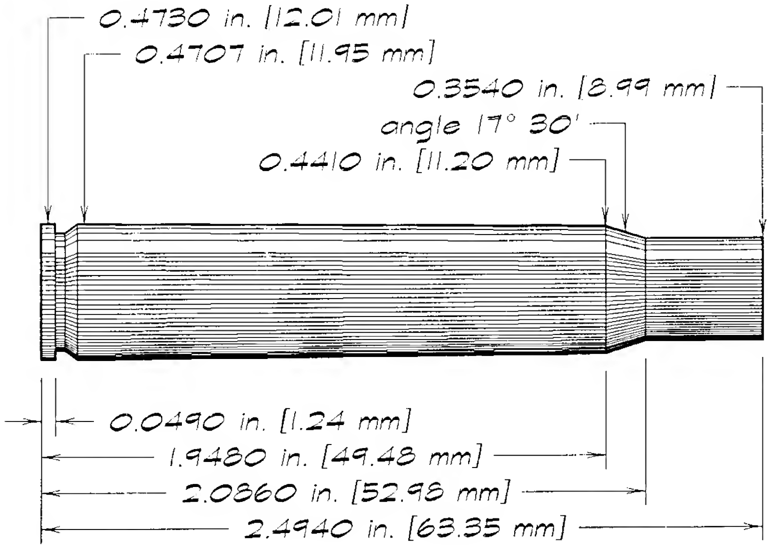
Use factory 8mm Steyr brass. No satisfactory substitute exists.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

8mm-06

(RCBS drawing)

solid:
824 gr brass
97 gr water



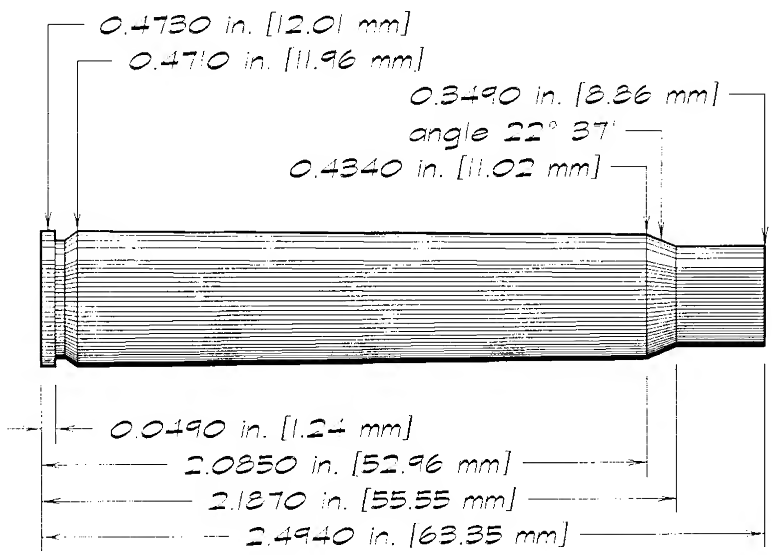
.323 bullet displaces
20.72 grains per inch.

Fire-form .30-06 brass with inert filler, or resize .35 Whelen brass full-length in 8mm-06 sizer die.

8mm-06 Davis Improved

(designer's specs)

solid:
828 gr brass
97 gr water

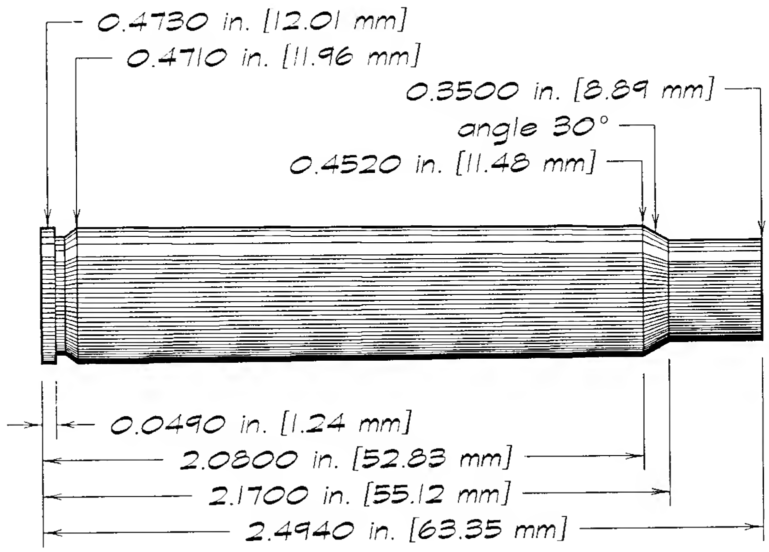


.323 bullet displaces
20.72 grains per inch.

Fire-form .30-06 Springfield brass with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

8mm-06 Max M (designer's specs)

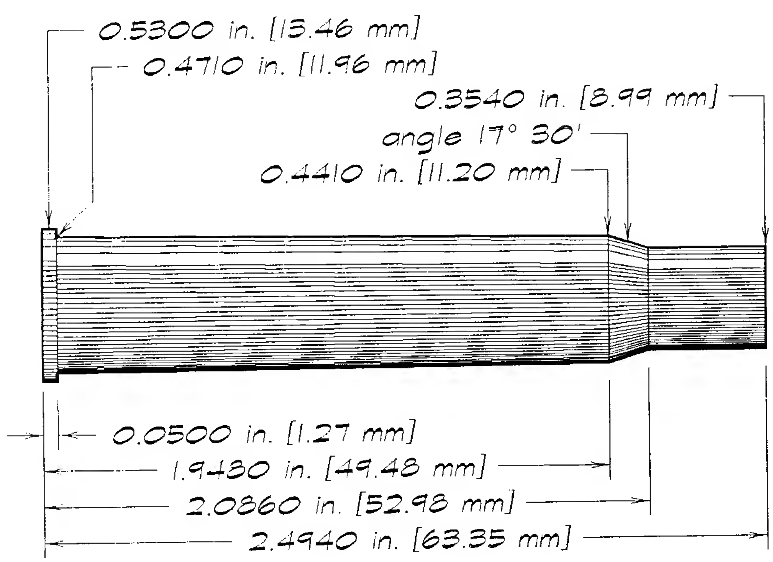


solid:
843 gr brass
99 gr water

.323 bullet displaces
20.72 grains per inch.

Anneal neck, shoulder, and upper body of .35 Whelen brass. Resize full-length in 8mm-06 Max M sizer die. Fire-form with inert filler.

8mm-06 Rimmed (designer's specs)



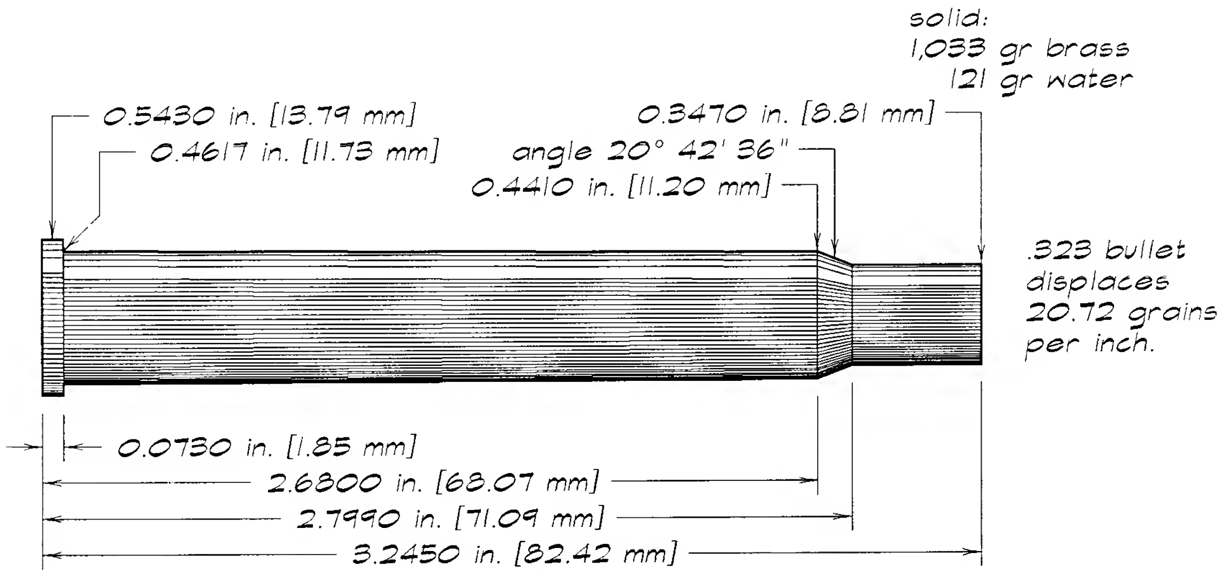
solid:
748 gr brass
88 gr water

.323 bullet displaces
20.72 grains per inch.

Trim .400-.350 NE brass to 2½ inches and resize full-length in 8mm-06 Rimmed sizer die. Fire-form with inert filler. Trim to 2.49 inches and deburr.

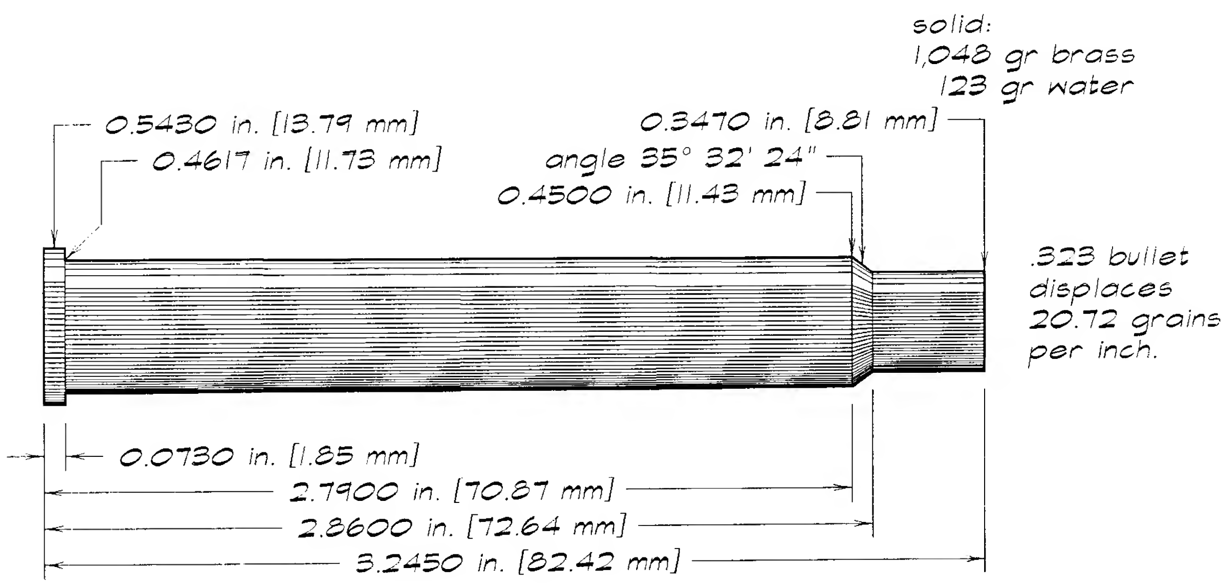
Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

8mm x 3¼-Inch Davis Express Number 1 (designer's specs)



Anneal neck-and-shoulder area of .405 3¼-inch Basic brass and form in RCBS form dies. Trim, chamfer, and fire-form.

8mm x 3¼-Inch Davis Express Number 2 (designer's specs)



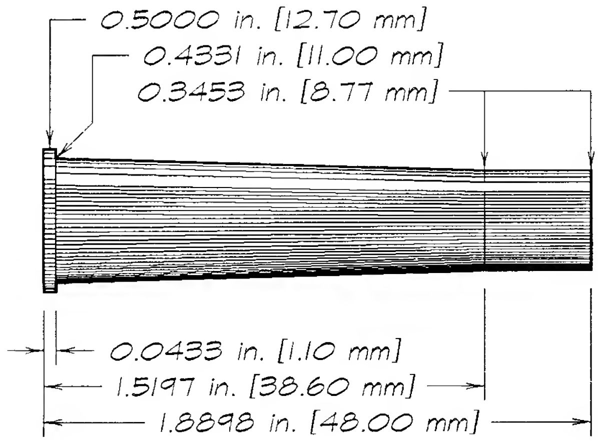
Anneal neck-and-shoulder area of .405 3¼-inch Basic brass and form in RCBS form dies. Trim, chamfer, and fire-form.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

8x48mm Rimmed (Sauer)

(Triebel maximums)

solid:
473 gr brass
55 gr water



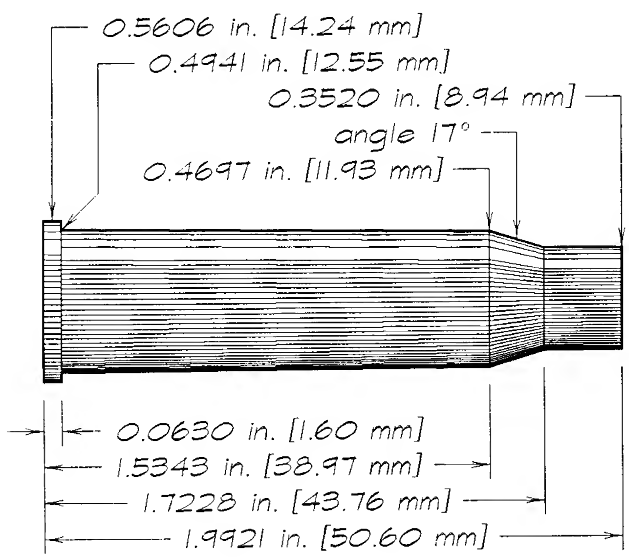
.318 bullet displaces
20.08 grains per inch.

Form from .303 Savage brass, in RCBS form dies.

8x50mm Rimmed

(CIP maximums)

solid:
724 gr brass
85 gr water



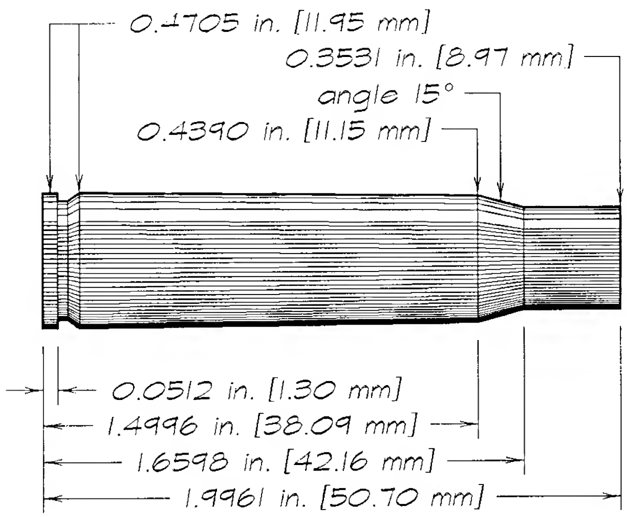
.324 bullet displaces
20.85 grains per inch.

Use recently manufactured 8x50R brass. Or form from 8x56mm Rimmed Hungarian brass, in RCBS trim die. Deburr.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

8x51mm Mauser K

(CIP maximums)



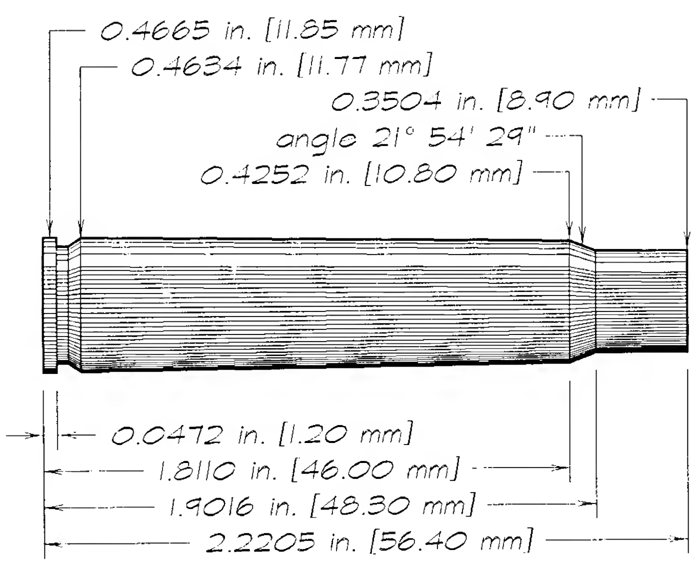
solid:
649 gr brass
76 gr water

.318 bullet displaces
20.08 grains per inch.

Use factory 8x51mm brass. Or anneal neck and shoulder of .308 Winchester brass, resize full-length in body of 8x51mm K sizer die (without decapper-expander plug), trim to 1.99 inches, deburr, and fire-form with inert filler.

8x56mm Mannlicher Schoenauer

(CIP maximums)



solid:
714 gr brass
84 gr water

.325 bullet displaces
20.98 grains per inch.

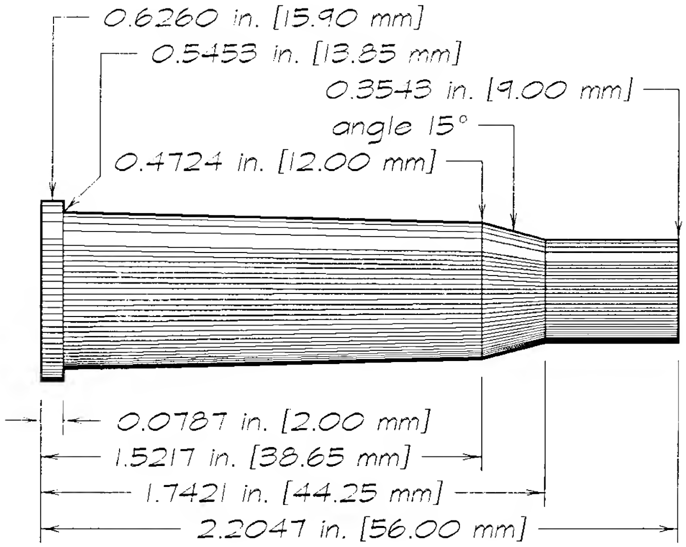
Use factory 8x56mm MS brass. Or form from 8x57mm Mauser brass, in RCBS form-and-trim die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

8x56mm Rimmed M30

(CIP maximums)

solid:
842 gr brass
99 gr water



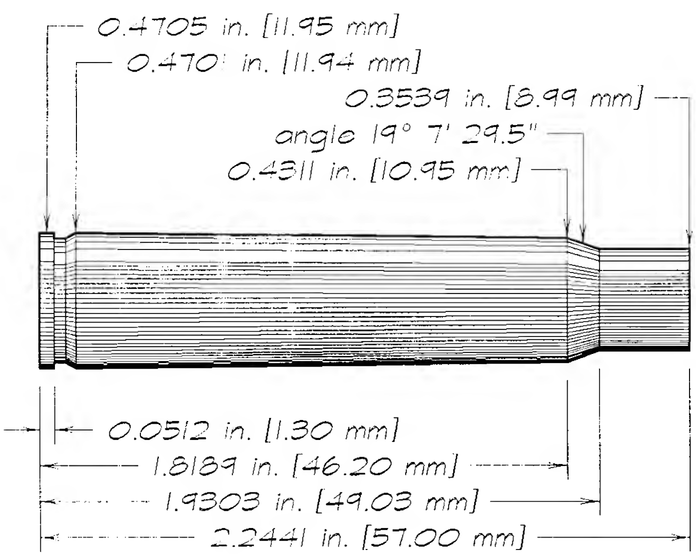
.323 bullet displaces
20.72 grains per inch.

Use recently manufactured 8x56R M30 brass. Or form from .450 NE 3½-Inch, .450-.400 NE 3-Inch, or .450 NE Basic brass, in RCBS form-and-trim die. Adjust forming, sizing, and seating dies to headspace cases on the shoulder instead of the rim. The 8x56mm Rimmed M30 rim is nearly twice as thick as the rim of the .450 NE brass.

8x57mm J Mauser

(CIP maximums)

solid:
739 gr brass
87 gr water



.318 bullet displaces
20.08 grains per inch.

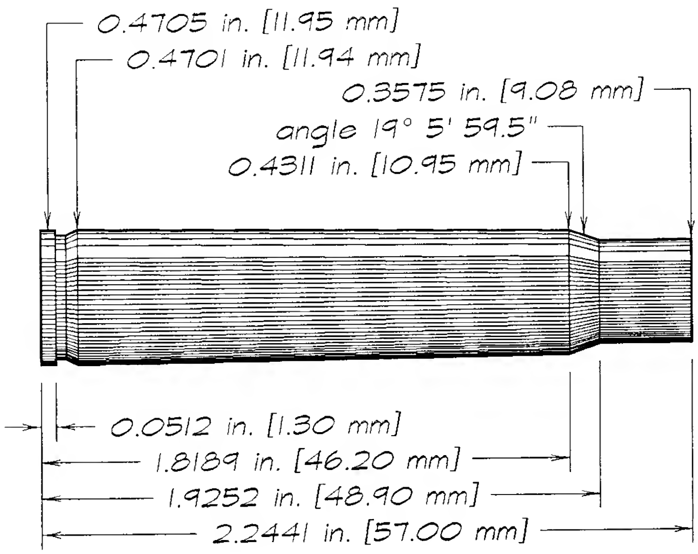
Use factory 8x57mm J brass, or the virtually identical 8x57mm JS brass. Or form from .35 Whelen or .30-06 Springfield brass, in RCBS form-and-trim die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

8x57mm JS Mauser

(CIP maximums)

solid:
739 gr brass
87 gr water



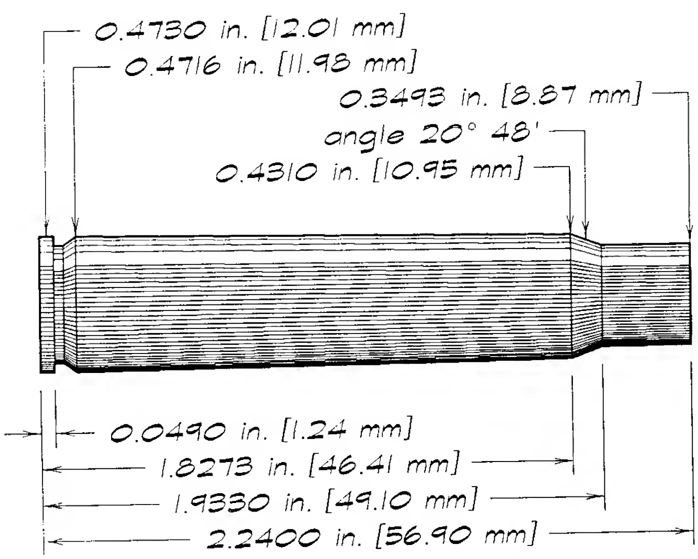
.323 bullet displaces
20.72 grains per inch.

Use factory 8x57mm JS Mauser brass, or the virtually identical 8x57mm J Mauser brass. Or form from .35 Whelen or .30-06 Springfield brass, in RCBS form-and-trim die.

8x57mm (8mm Mauser)

(SAAMI maximums)

solid:
738 gr brass
87 gr water



.323 bullet displaces
20.72 grains per inch.

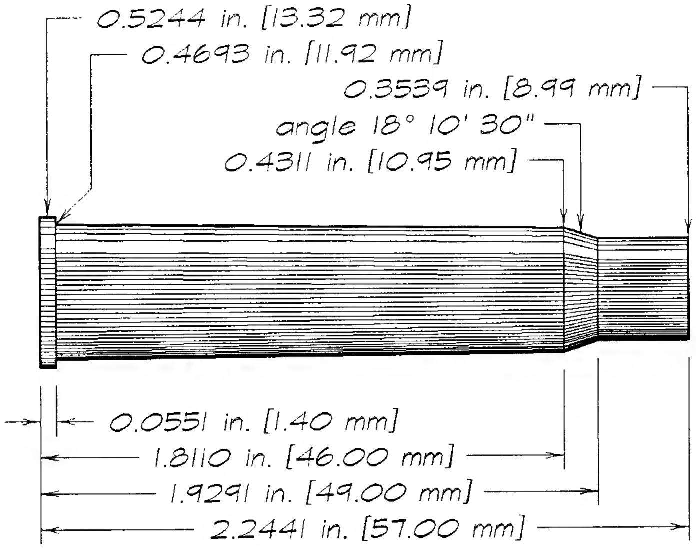
Use recently manufactured factory (Boxer-primed!) 8x57mm Mauser brass, or form from .30-06, .280, or .35 Whelen. Fire-form .280 or .30-06 with inert filler and trim to length. Resize .35 Whelen full-length in 8x57mm Mauser sizer die and trim to length.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

8x57mm Rimmed J Mauser

(CIP maximums)

solid:
724 gr brass
85 gr water



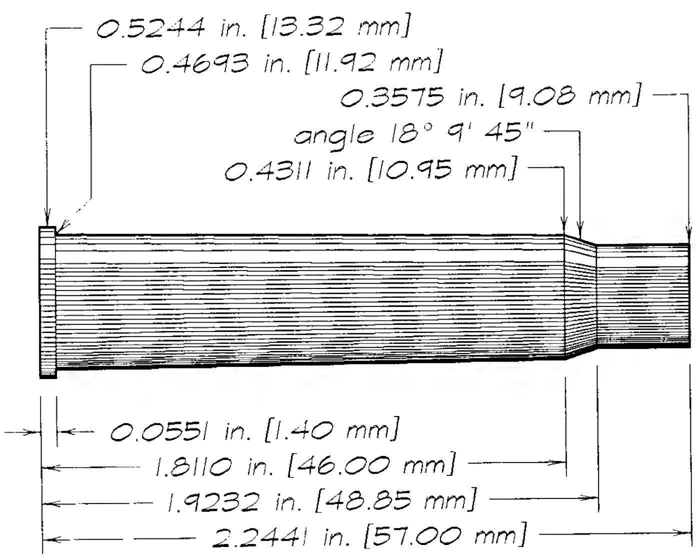
.318 bullet displaces
20.08 grains per inch.

Use factory 8x57mm Rimmed J Mauser brass, or the essentially identical 8x57mm Rimmed JS Mauser brass. Or form from 9.3x74mm Rimmed brass, in RCBS form-and-trim die.

8x57mm Rimmed JS Mauser

(CIP maximums)

solid:
727 gr brass
85 gr water



.323 bullet displaces
20.72 grains per inch.

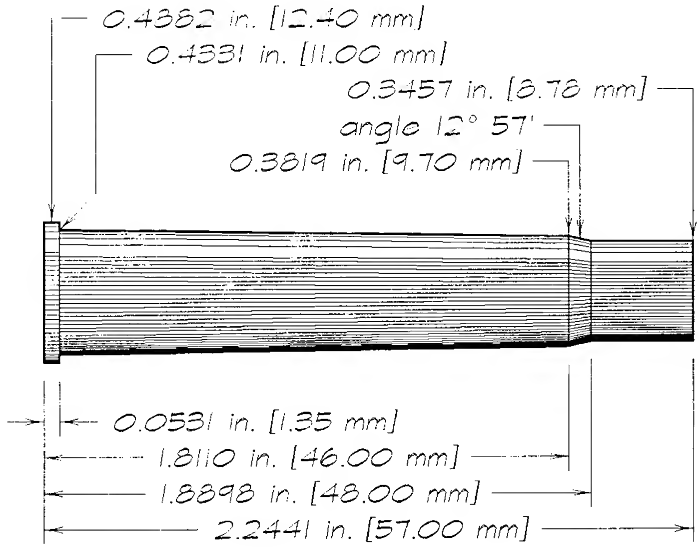
Use factory 8x57mm Rimmed JS Mauser brass, or the essentially identical 8x57mm Rimmed J Mauser brass. Or form from 9.3x74mm Rimmed brass, in RCBS form, trim, and ream dies.

Anneal only by method shown in text. **Text explains use of "solid" and displacement figures.**

8x57mm Rimmed 360

(CIP maximums)

solid:
611 gr brass
72 gr water



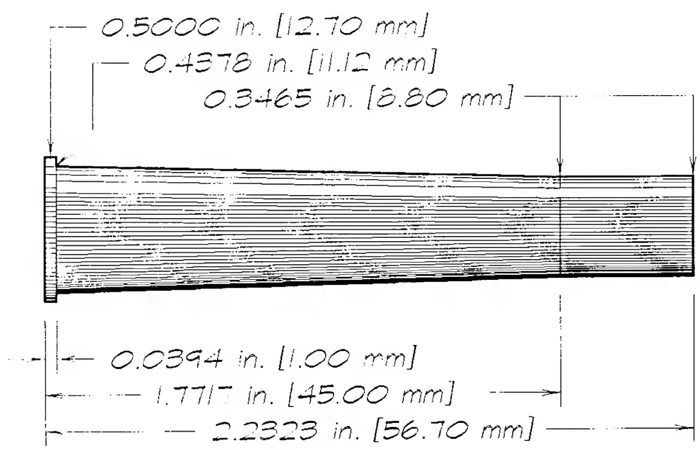
.318 bullet displaces
20.08 grains per inch.

Use factory 8x57mm Rimmed 360 brass. Or anneal neck and shoulder of 9.3x72mm Rimmed brass, in RCBS form-and-trim die. Deburr. Fire-form with inert filler.

8x57mm Rimmed (B Stahl)

(Triebel maximums)

solid:
563 gr brass
66 gr water



.318 bullet displaces
20.08 grains per inch.

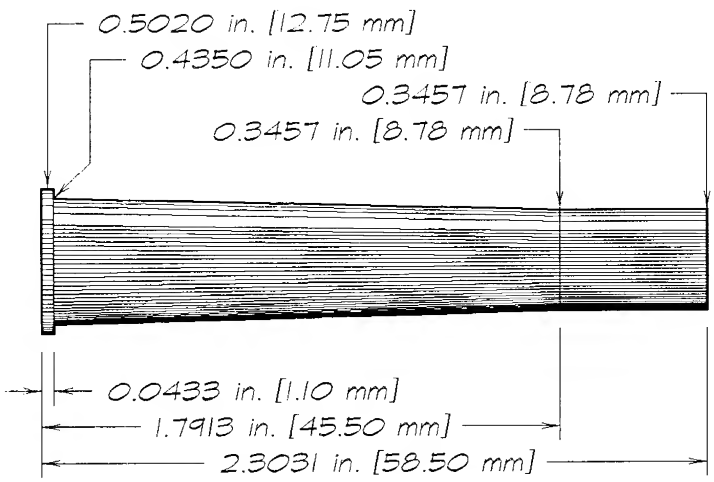
Form from 9.3x72mm Rimmed, in RCBS form-and-trim die.

Anneal only by method shown in text. ***Text explains use of "solid" and displacement figures.***

8x58mm Rimmed (Sauer)

(CIP maximums)

solid:
565 gr brass
66 gr water



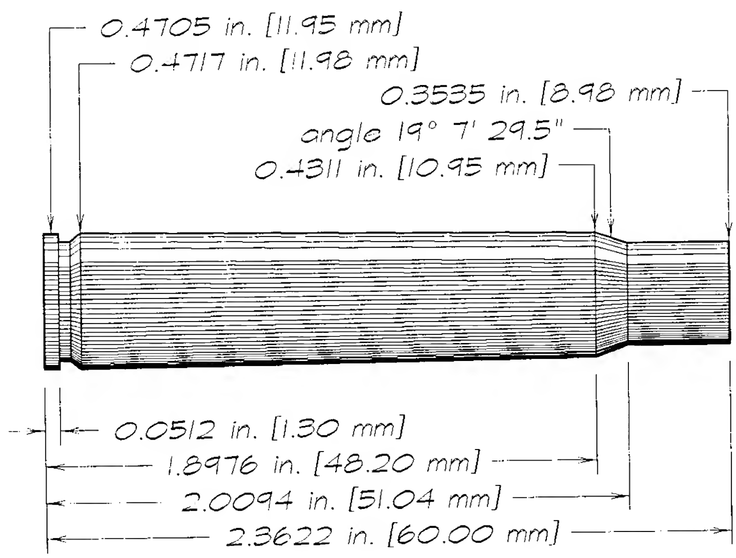
.318 bullet displaces
20.08 grains per inch.

Use recently manufactured 8x58mm Rimmed brass. Or form from 9.3x72mm Rimmed brass, in RCBS form-and-trim die.

8x60mm Mauser

(CIP maximums)

solid:
777 gr brass
91 gr water



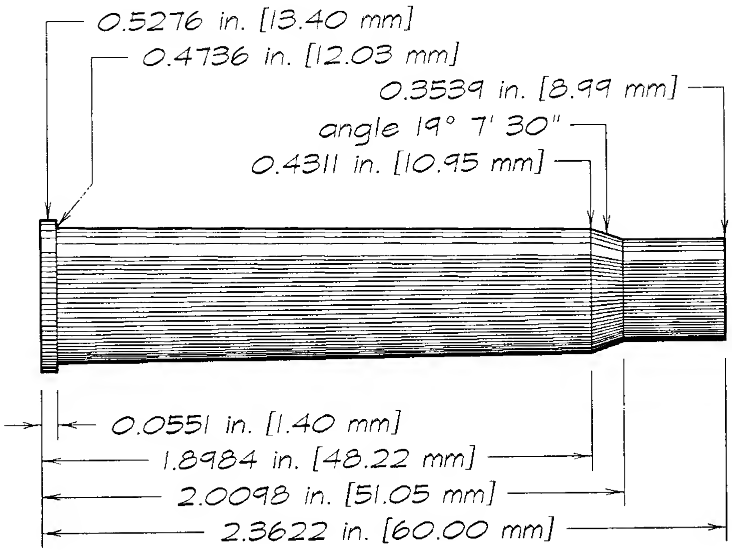
.318 bullet displaces
20.08 grains per inch.

Use factory 8x60mm Mauser brass, or the essentially identical 8x60mm S Mauser brass. Or anneal neck and shoulder of .30-06 Springfield brass, resize full-length in body of 8x60mm Mauser sizer die (with decapper-expander asembly removed), trim to 2.36 inches, deburr, and fire-form with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

8x60mm Rimmed

(CIP maximums)



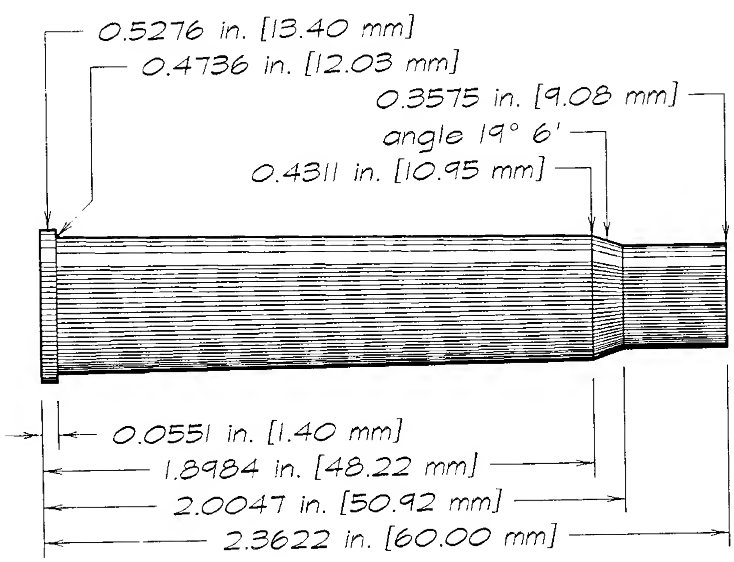
solid:
768 gr brass
90 gr water

.318 bullet displaces
20.08 grains per inch.

Use factory 8x60mm Rimmed brass, or the essentially identical 8x60mm Rimmed S brass, or form from 9.3x74mm Rimmed brass, in RCBS form, trim, and ream dies.

8x60mm Rimmed S Mauser

(CIP maximums)



solid:
768 gr brass
90 gr water

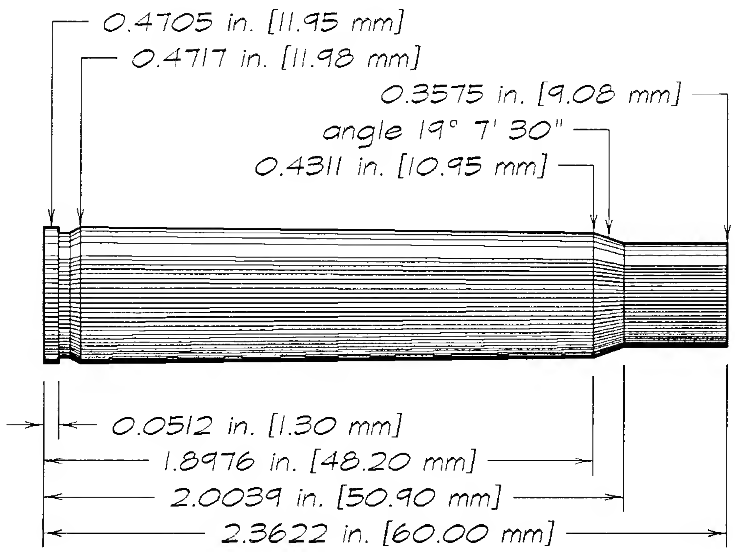
.323 bullet displaces
20.72 grains per inch.

Use factory 8x60RS Mauser or 8x60mm Rimmed Mauser brass. Or anneal neck and shoulder of 9.3x74R brass and form in RCBS form, trim, and ream dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

8x60mm S Mauser (CIP maximums)

solid:
779 gr brass
91 gr water

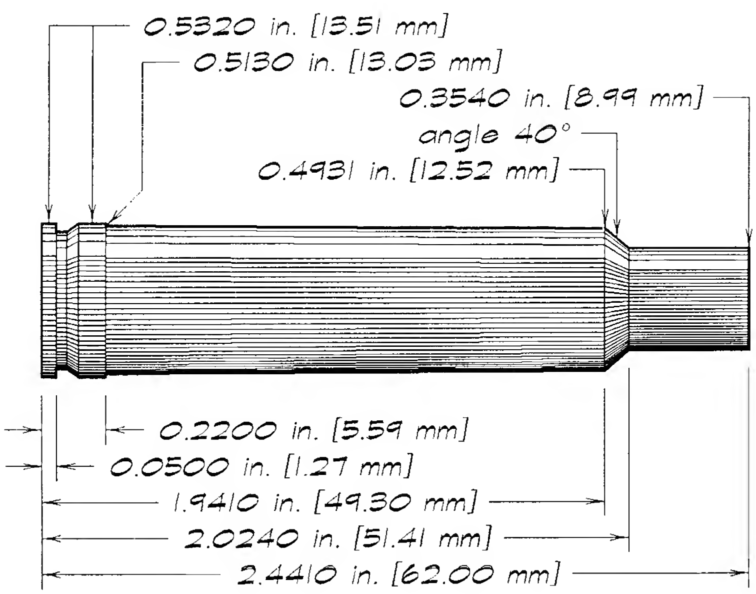


.323 bullet displaces 20.72 grains per inch.

Use factory 8x60mm S Mauser brass, or the essentially identical 8x60mm Mauser brass. Or anneal neck and shoulder of .30-06 Springfield brass, resize full-length in body of 8x60mm S Mauser sizer die (without decapper-expander plug), trim to 2.36 inches, deburr, and fire-form with inert filler.

8x62mm-.338 Hayes Magnum (designer's drawing)

solid:
963 gr brass
113 gr water



.323 bullet displaces 20.72 grains per inch.

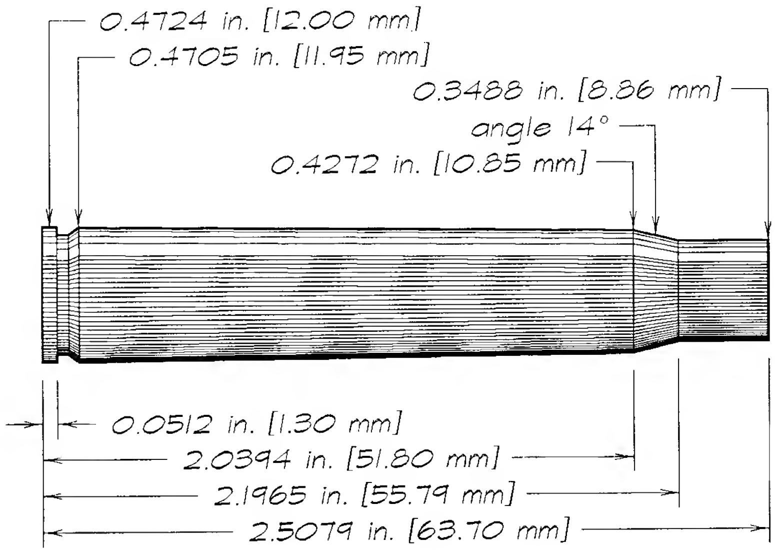
Anneal neck and shoulder of .338 Winchester Magnum brass and resize full-length in 8x62mm Hayes sizer die. Trim to 2.44 inches; deburr. Fire-form with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

8x64mm

(CIP maximums)

solid:
820 gr brass
96 gr water



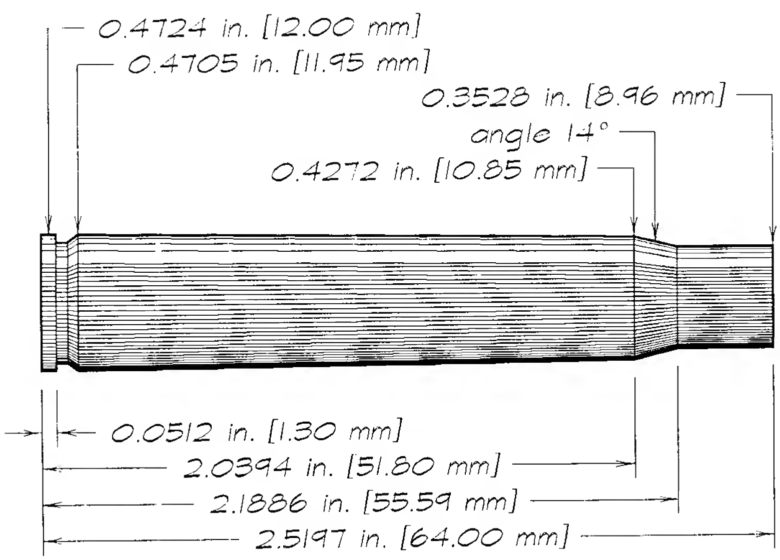
.318 bullet displaces
20.08 grains per inch.

Use factory 8x64mm brass. Or resize .35 Whelen or .30-06 Springfield brass full-length in 8x64mm sizer die.

8x64mm S

(CIP maximums)

solid:
830 gr brass
97 gr water



.323 bullet displaces
20.72 grains per inch.

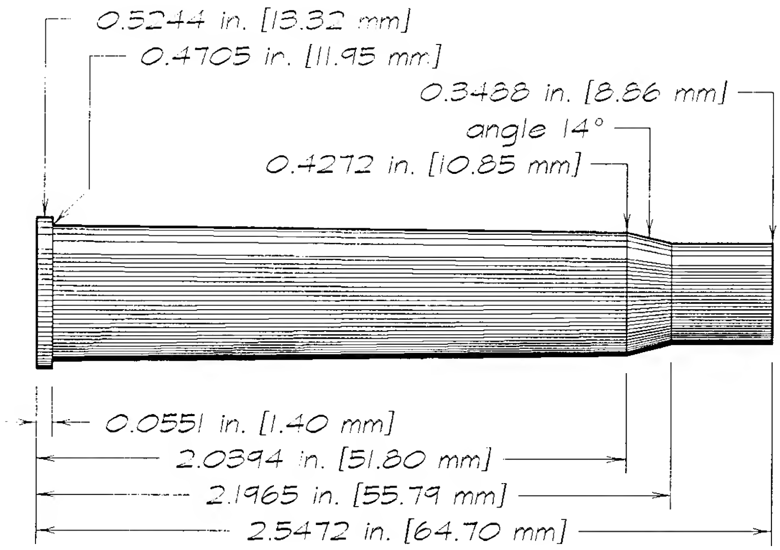
Use recently manufactured 8x64mm S brass. Or form from .30-06 Springfield brass, in RCBS form die.

Anneal only by method shown in text. ***Text explains use of "solid" and displacement figures.***

8x65mm Rimmed

(CIP maximums)

solid:
816 gr brass
96 gr water



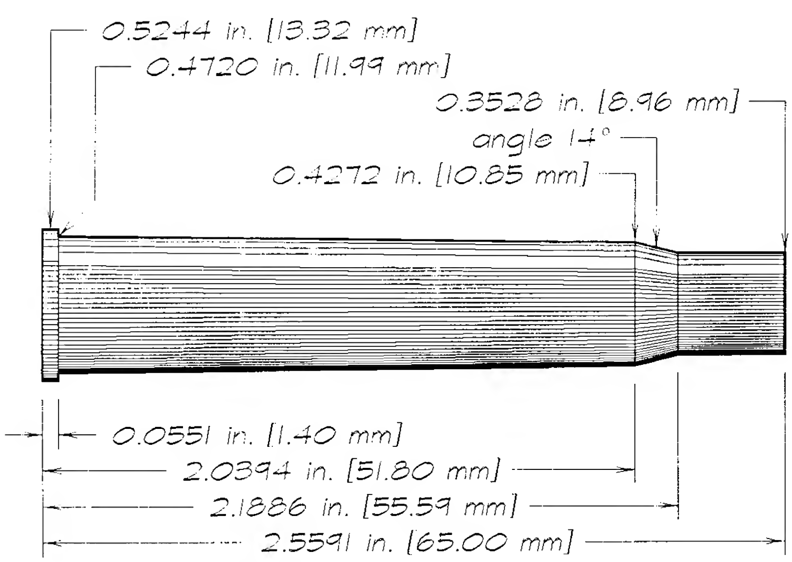
.318 bullet displaces
20.08 grains per inch.

Use factory 8x65mm Rimmed brass, or the essentially identical 8x65mm Rimmed S brass. Or form from 9.3x74mm Rimmed brass, in RCBS form-and-trim die.

8x65mm Rimmed S

(CIP maximums)

solid:
822 gr brass
96 gr water



.323 bullet displaces
20.72 grains per inch.

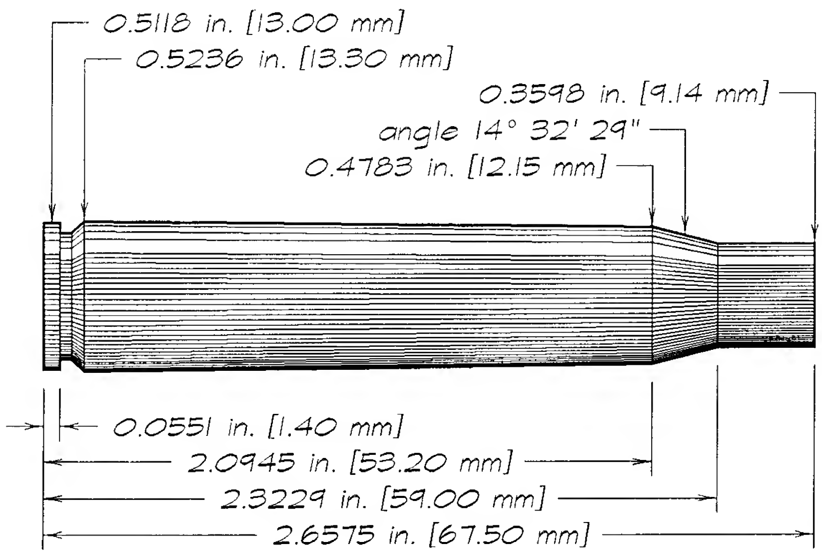
Use factory 8x65mm Rimmed S brass, or the essentially identical 8x65mm Rimmed brass. Or form from 9.3x74mm Rimmed brass, in RCBS form-and-trim die.

Anneal only by method shown in text.   Text explains use of "solid" and displacement figures.

8x68mm S

(CIP maximums)

solid:
1,040 gr brass
122 gr water



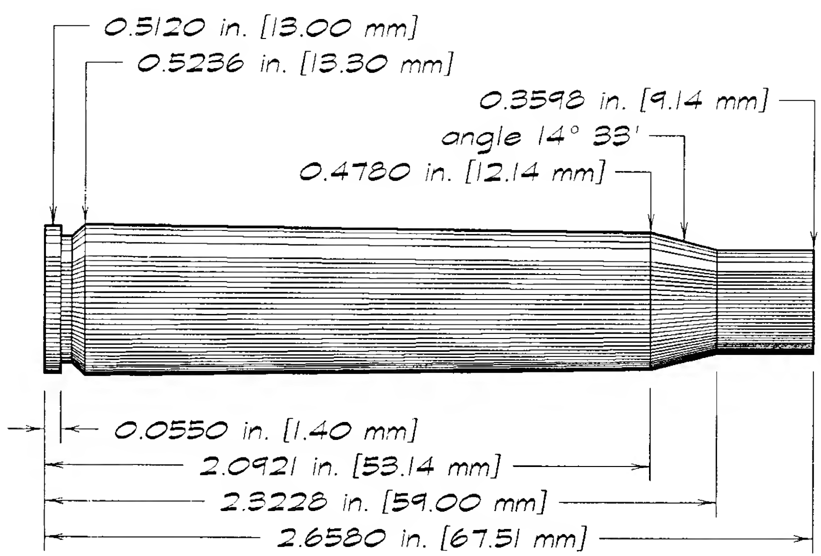
.323 bullet displaces
20.72 grains per inch.

Use factory 8x68mm S brass. No easily modifiable substitute exists.

8x68mm S Magnum

(RCBS drawing)

solid:
1,039 gr brass
122 gr water

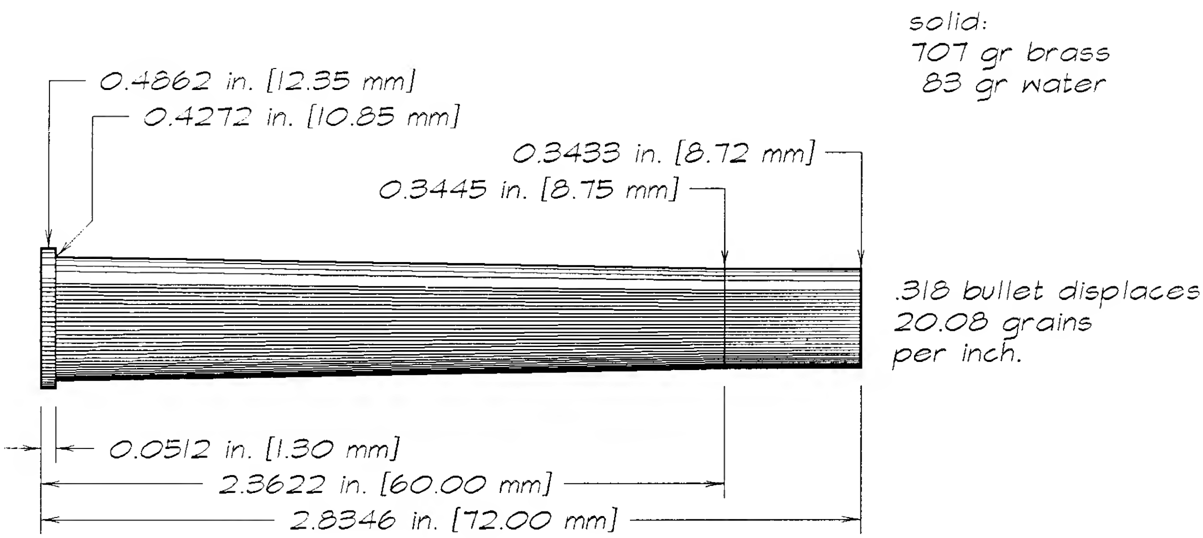


.323 bullet displaces
20.72 grains per inch.

Use factory 8x68S brass. There's no easily modifiable substitute.

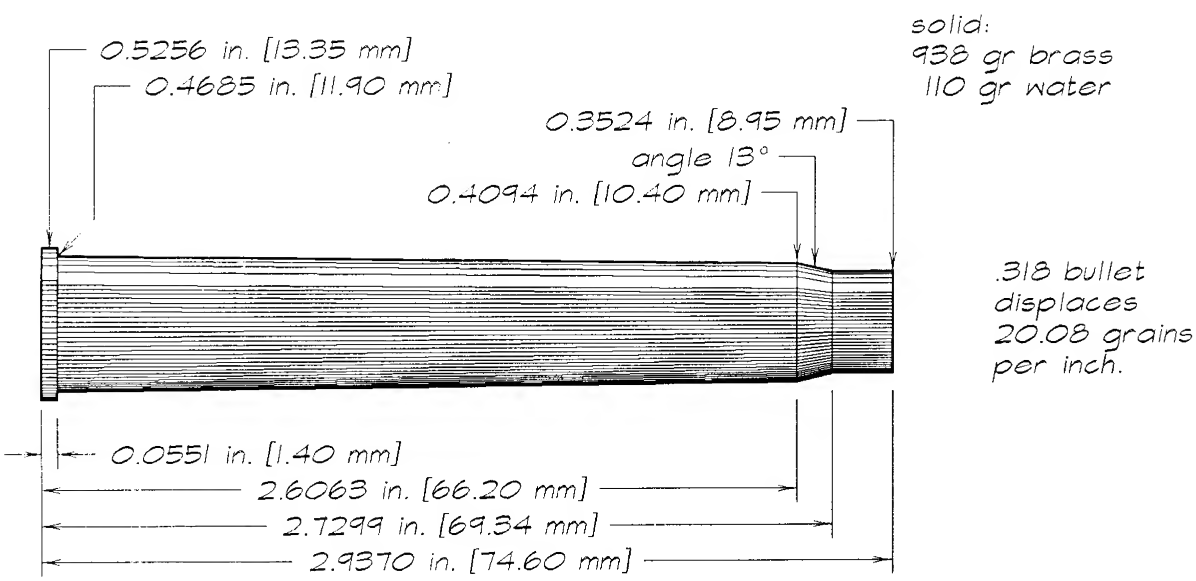
Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

8x72mm Rimmed (CIP maximums)



Use factory 8x72mm Rimmed brass. Or form from 9.3x72mm Rimmed brass, in RCBS form and trim dies. Deburr.

8x75mm Rimmed (.318) (Triebel maximums)

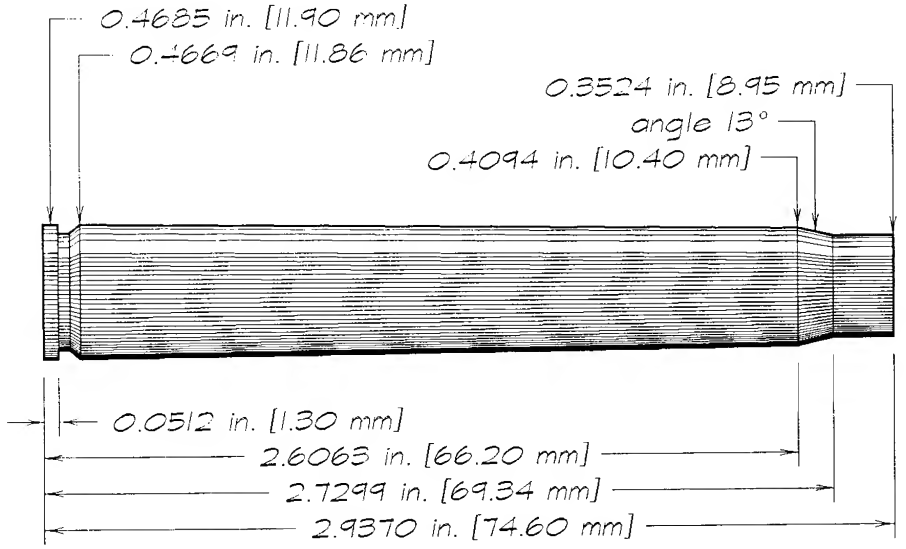


Resize 9.3x74mm Rimmed brass full-length in 8x75mm sizer die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

8x75mm (.318) (Triebel maximums)

solid:
957 gr brass
112 gr water

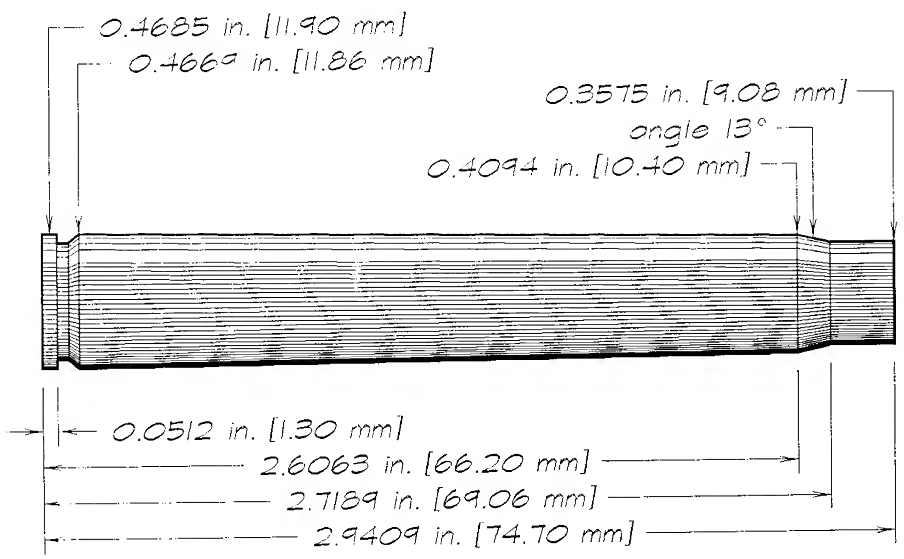


.318 bullet displaces 20.08 grains per inch.

No satisfactory substitute exists. (9.3x74mm Rimmed brass requires turning rim and groove to 8x75mm dimensions.)

8x75mm S (CIP maximums)

solid:
958 gr brass
112 gr water



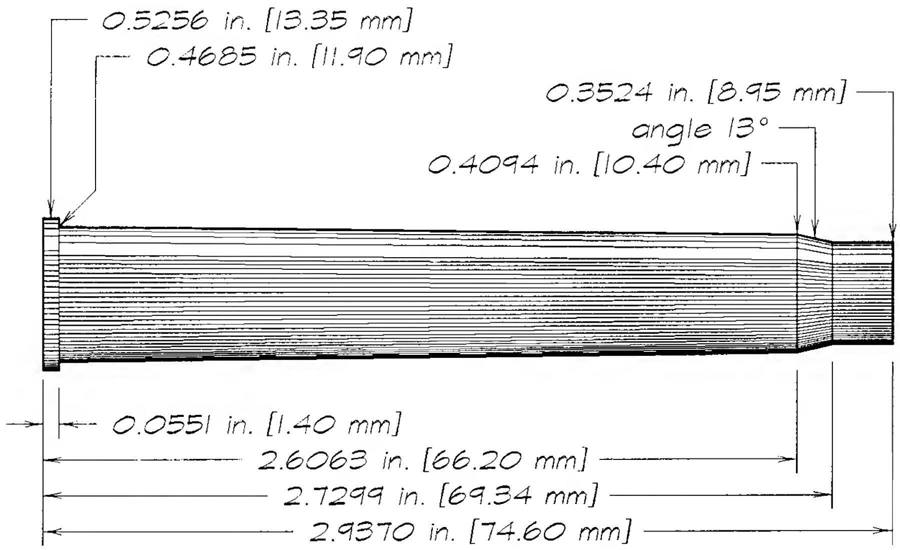
.323 bullet displaces 20.72 grains per inch.

Use factory 8x75mm brass. No easily modifiable substitute exists.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

8x75mm Rimmed (.318) (Triebel maximums)

solid:
938 gr brass
110 gr water

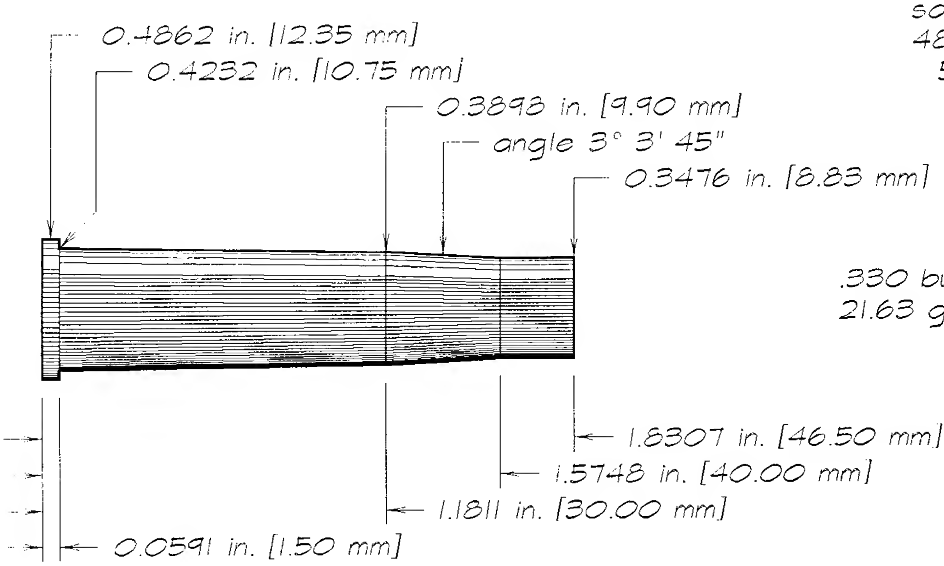


.318 bullet displaces 20.08 grains per inch.

Resize 9.3x74mm Rimmed brass full-length in 8x75mm sizer die.

8.15x46mm Rimmed (CIP maximums)

solid:
484 gr brass
57 gr water



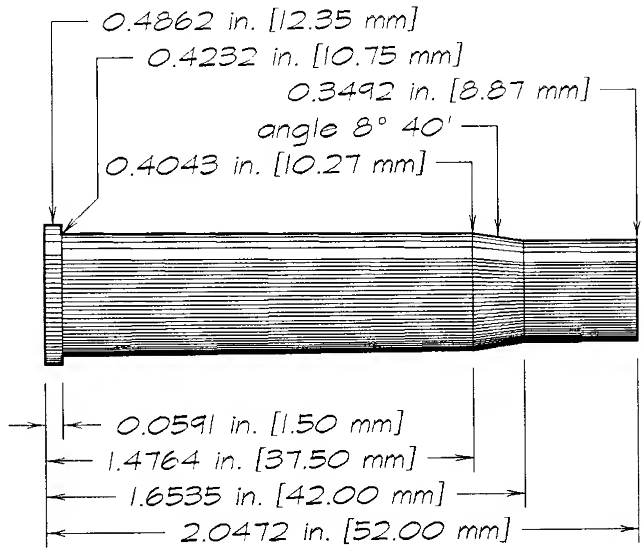
.330 bullet displaces 21.63 grains per inch.

Use factory 8.15x46mm Rimmed brass. Or form from .30-30 Winchester brass in RCBS form-and-trim die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

8.15x52mm Rimmed (Frohn)

(Triebel maximums)



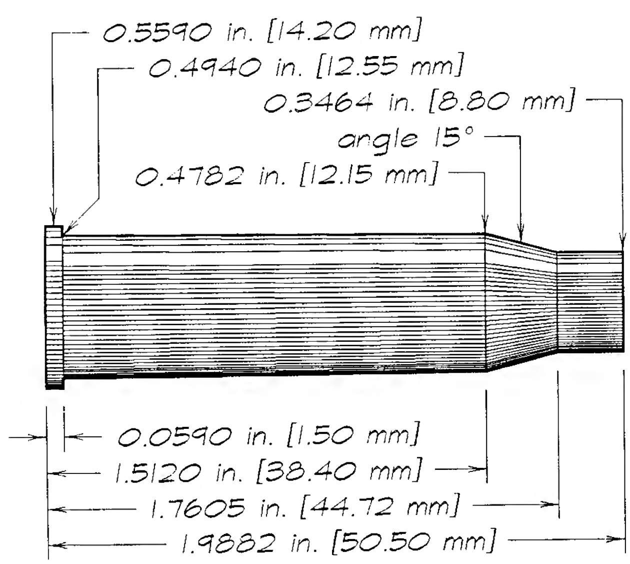
solid:
558 gr brass
65 gr water

.323 bullet displaces 20.72 grains per inch.

Fire-form .30-30 Winchester or .32 Winchester Special brass with inert filler.

8.2x50mm Rimmed

(Brno drawing, 1940)



solid:
749 gr brass
88 gr water

.323 bullet (?) displaces 20.72 grains per inch.

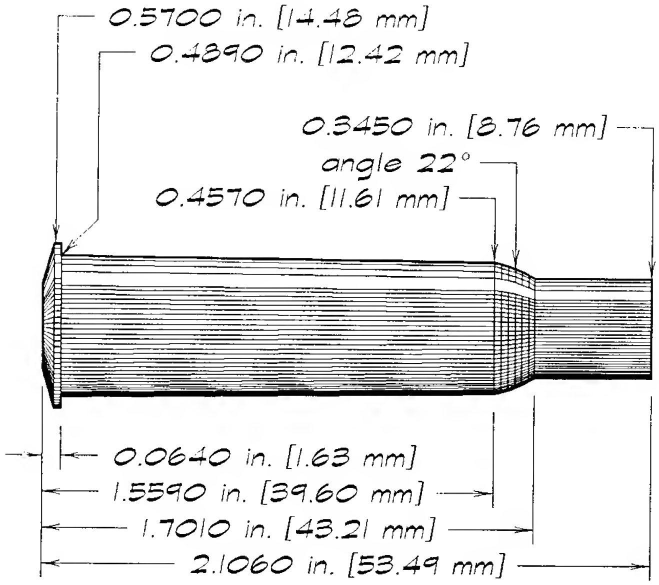
Use 8x50mm Rimmed brass. Or form 8x56mm Rimmed Hungarian in RCBS 8x50mm Rimmed form-and-trim die. Trim and deburr.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

8.2x53mm Rimmed (Finland)

(unfired specimen)

solid:
710 gr brass
83 gr water



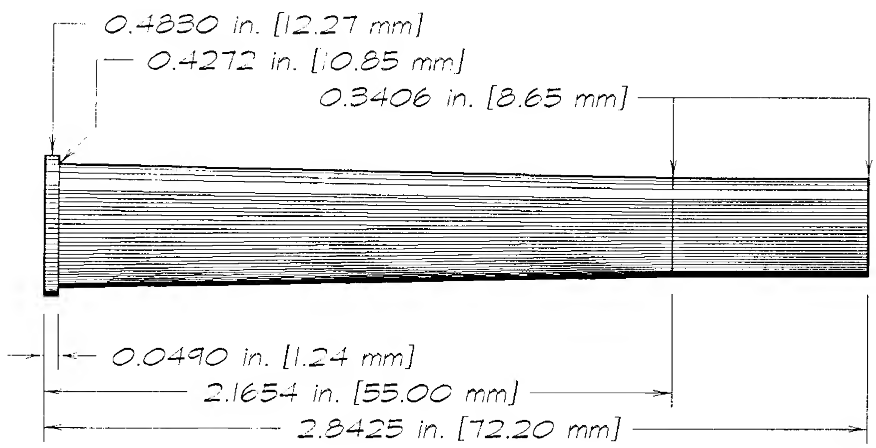
.323 bullet displaces
20.72 grains per inch.

Resize 7.62mm Russian brass full-length in 8.2x53R sizer die.

8.2x72mm Rimmed

(Brno drawing, 1942)

solid:
691 gr brass
81 gr water



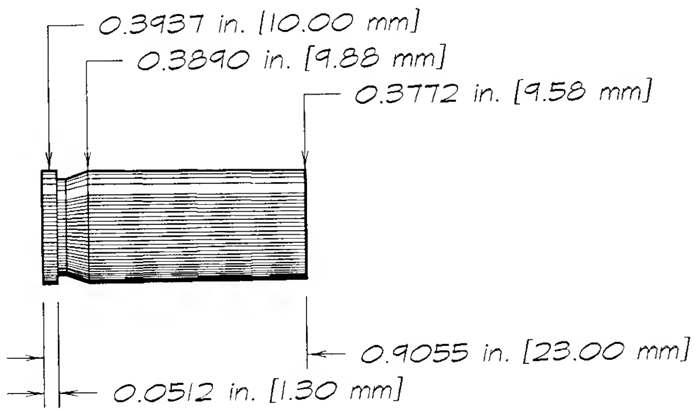
Try 9.3x72mm Rimmed brass.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

9mm Bergmann Bayard

(Triebel maximums)

solid:
222 gr brass
26 gr water



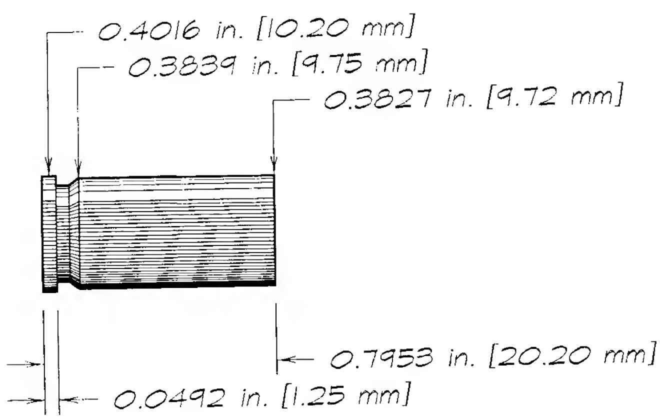
.357 bullet displaces
25.31 grains per inch.

Trim 9mm Winchester Magnum brass to 0.9 inch and deburr.

9mm Browning Long

(Triebel maximums)

solid:
200 gr brass
23 gr water



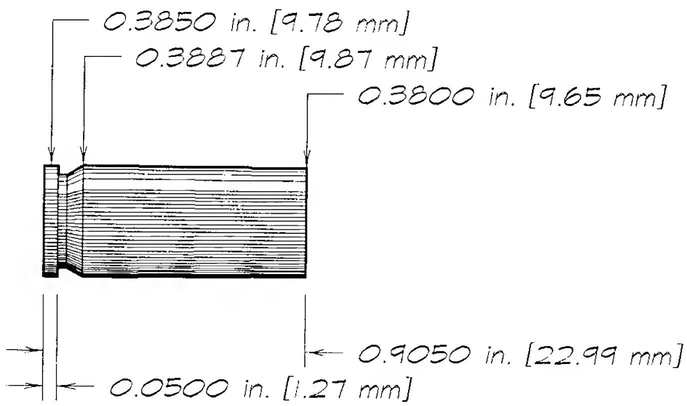
.357 bullet displaces
25.31 grains per inch.

Trim .38 Automatic or .38 Super Automatic brass to 0.795 inch and deburr.

Anneal only by method shown in text. **Text explains use of "solid" and displacement figures.**

9mm Largo (Cartucheria Española)

solid:
221 gr brass
26 gr water

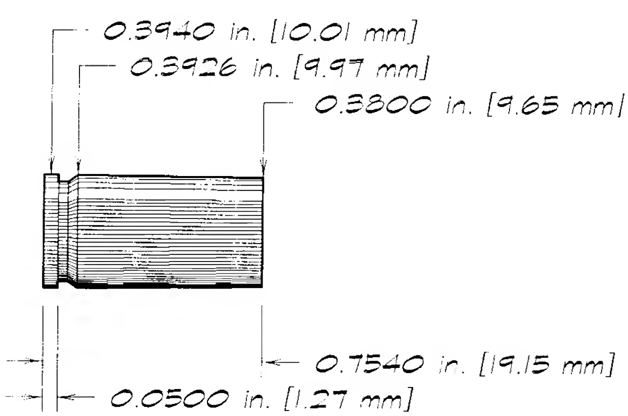


.355 bullet displaces
25.03 grains per inch.

.38 Automatic brass may work all right, with the rim turned to 0.385 inch. Or resize 9mm Winchester brass full-length in 9mm Largo sizer. Trim to 0.905 inch. Deburr.

9mm Luger (9mm Parabellum) (SAAMI maximums)

solid:
189 gr brass
22 gr water



.355 bullet displaces
25.03 grains per inch.

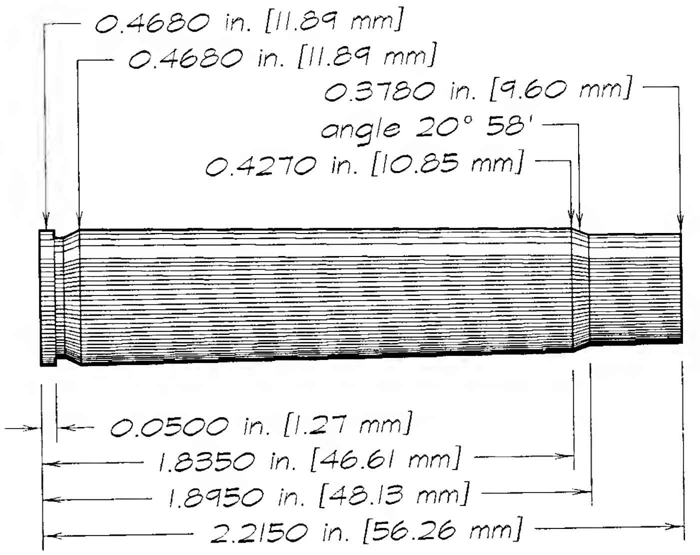
Use Boxer-primed factory 9mm Luger cases. Or form from .38 Super Auto brass: resize full-length (well lubricated) in 9mm Luger sizer die. Adjust handle of press for high leverage if it has this alternative adjustment.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

9mm Mannlicher Schoenauer

(ICI Metals Ltd dwg)

solid:
732 gr brass
86 gr water



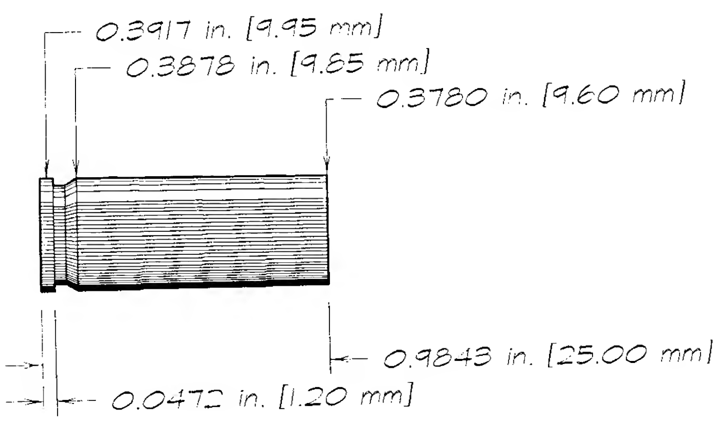
.355 bullet displaces
25.03 grains per inch.

Fire-form 8x57mm Mauser brass with inert filler. Trim to 2.21 inches. Deburr. Or form from .30-06 Springfield brass, in RCBS form-and-trim die.

9mm Mauser

(Triebel maximums)

solid:
242 gr brass
28 gr water



.358 bullet displaces
.25.46 grains per inch.

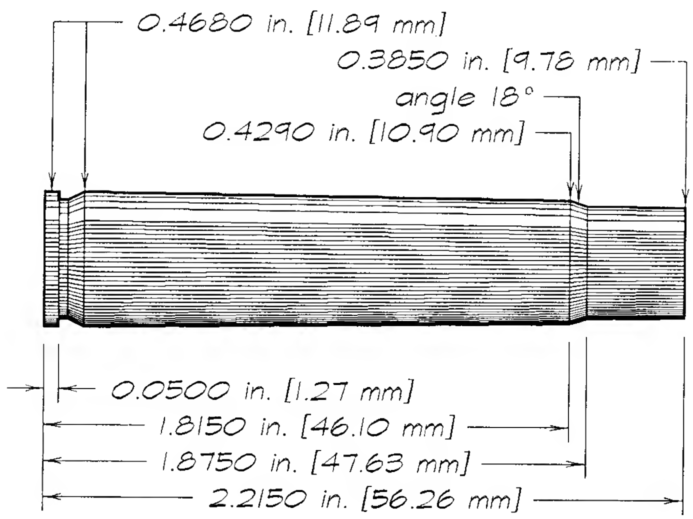
Trim 9mm Winchester Magnum brass to 0.984 inch and deburr.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

9mm Mauser (rifle)

(ICI Metals Ltd dwg)

solid:
733 gr brass
86 gr water



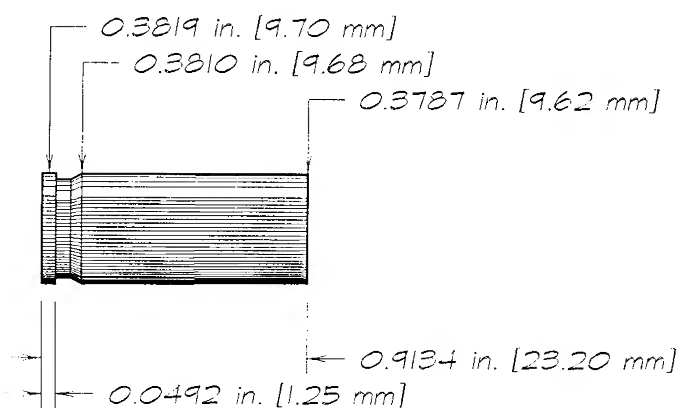
.357 bullet displaces
25.31 grains per inch.

Form from .30-06 Springfield or 8x57mm Mauser brass, in respective RCBS form die. Trim to 2¼ inches. Fire-form with inert filler. Trim to 2.215 inches and deburr.

9mm Steyr

(CIP maximums)

solid:
218 gr brass
26 gr water



.355 bullet displaces
25.03 grains per inch.

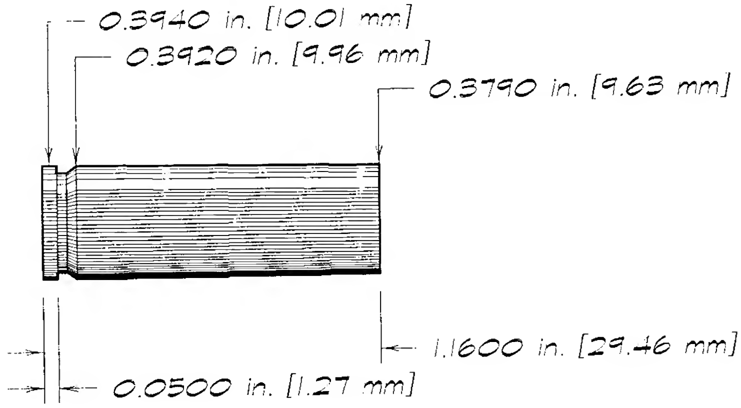
Use factory 9mm Steyr brass. Or use .38 Super Automatic or .38 Automatic brass (turn rim to 0.38 inch if necessary).

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

9mm Winchester Magnum

(SAAMI maximums)

solid:
290 gr brass
34 gr water



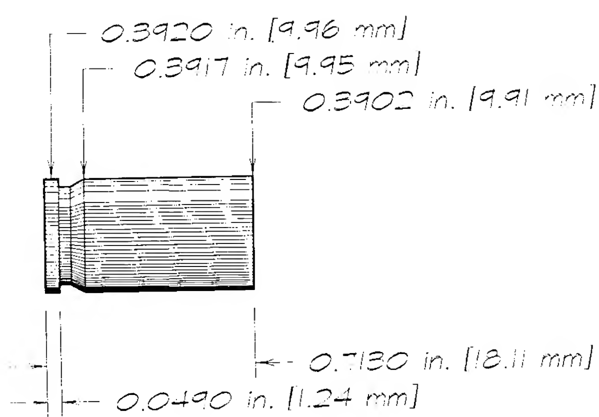
.355 bullet displaces 25.03 grains per inch.

Use 9mm Winchester Magnum brass.

9x18mm Makarov

(SAAMI maximums)

solid:
177 gr brass
21 gr water



.365 bullet displaces 26.46 grains per inch.

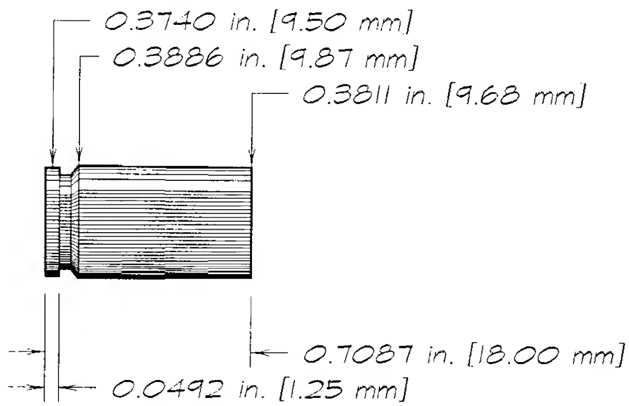
Use factory 9x18mm Makarov brass. Or expand mouth of 9mm Luger brass, trim to 0.713 inch, and deburr.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

9x18mm Ultra

(CIP maximums)

solid:
172 gr brass
20 gr water



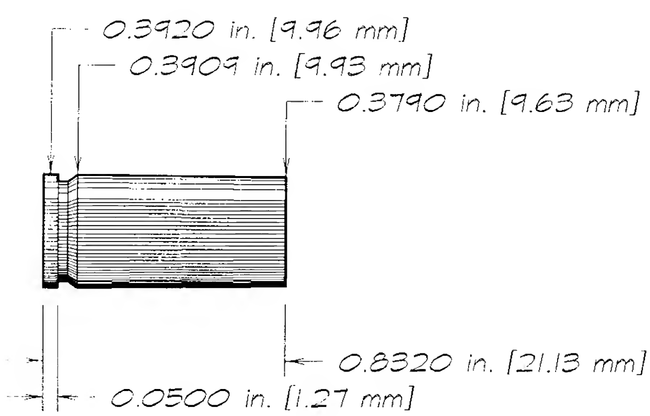
.355 bullet displaces
25.03 grains per inch.

Use factory 9x18mm Ultra brass. Or turn 9mm Luger rim to 0.373 inch and resize full-length in 9x18mm Ultra sizer die, trim to 0.708 inch, and deburr.

9x21mm IMI (Israel)

(CIP maximums)

solid:
207 gr brass
24 gr water



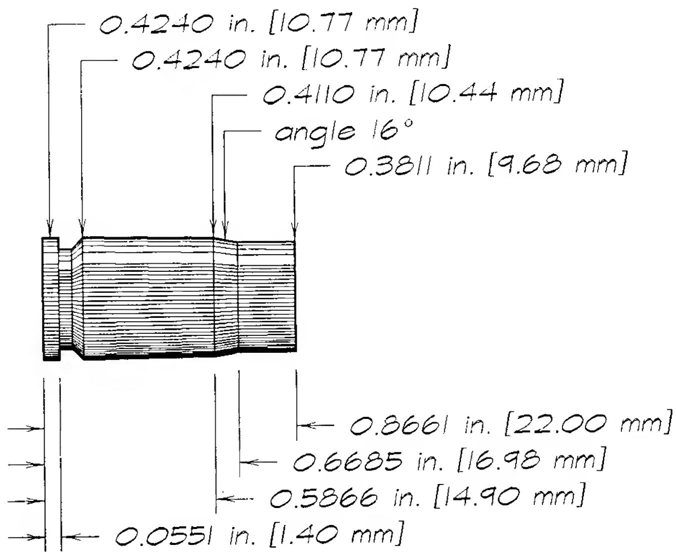
.355 bullet displaces
25.03 grains per inch.

Use factory 9x21 IMI brass.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

9x22mm MJR

(CIP maximums)



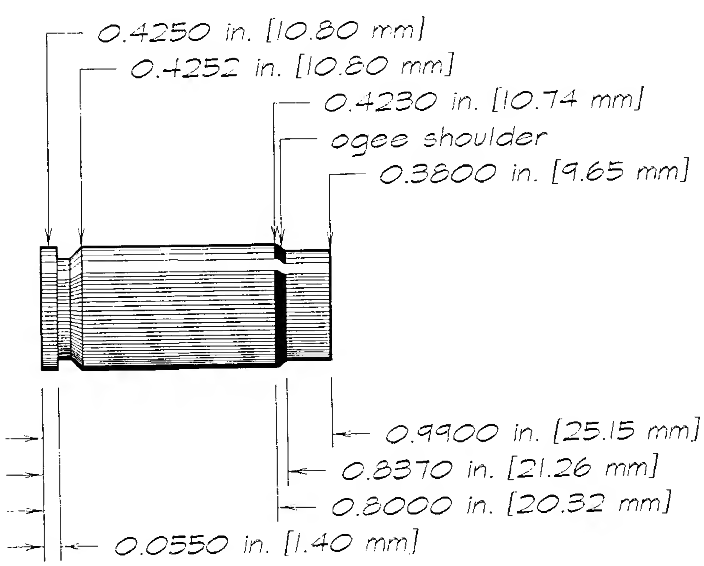
solid:
243 gr brass
28 gr water

.356 bullet displaces
25.17 grains per inch.

Use factory 9x22mm MJR brass. Or resize 10mm Automatic brass full-length in 9x22mm MJR sizer die, trim to length, and deburr.

9x25mm Dillon

(Dillon drawing)



solid:
284 gr brass
33 gr water

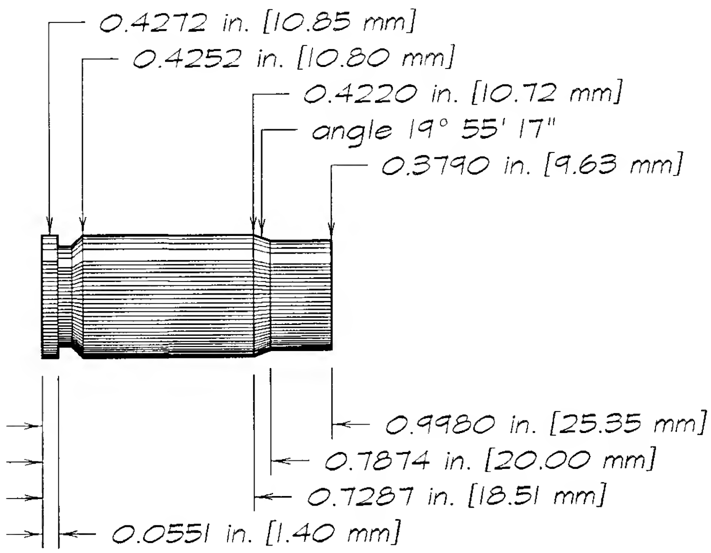
.356 bullet displaces
25.17 grains per inch.

Resize 10mm Auto brass full-length in 9x25mm Dillon sizer die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

9x25mm Super Auto G

(CIP maximums)



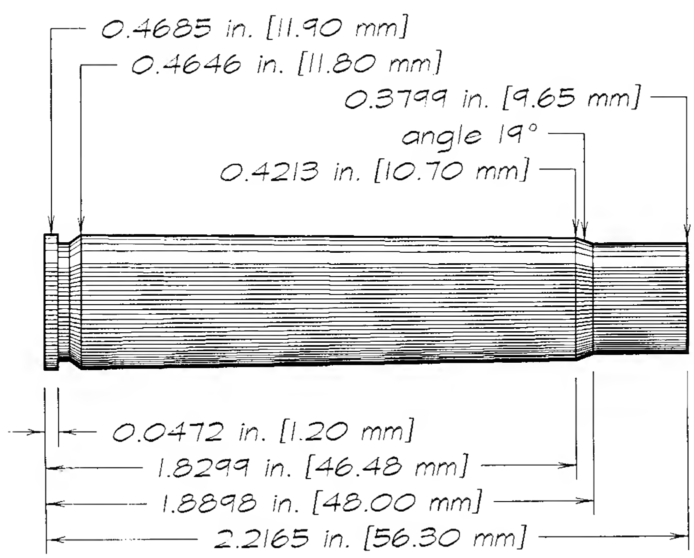
solid:
284 gr brass
33 gr water

.356 bullet displaces
25.17 grains per inch.

Use factory cases. Or resize 10mm Automatic brass full-length in 9x25mm Super Auto sizer die.

9x56mm Mannlicher Schoenauer

(Triebel maximums)



solid:
724 gr brass
85 gr water

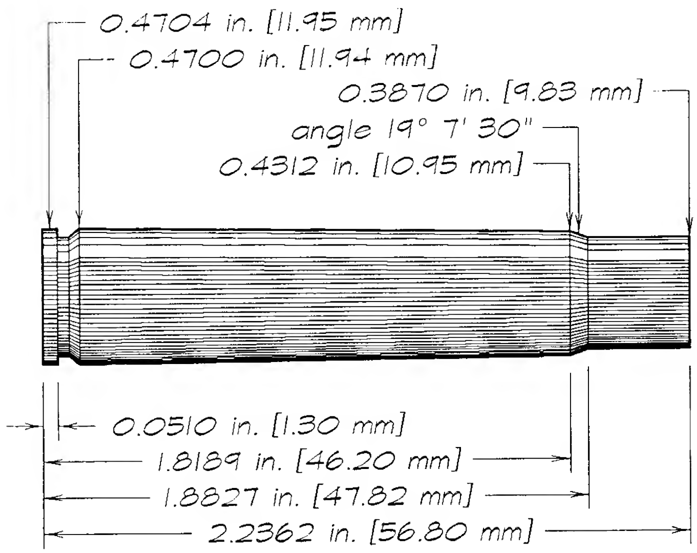
.357 bullet displaces
25.31 grains per inch.

Fire-form 8x57mm Mauser brass with inert filler. Trim to 2.21 inches. Deburr. Or form from .30-06 Springfield brass, in RCBS form-and-trim die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

9x57mm Mauser

(CIP maximums)



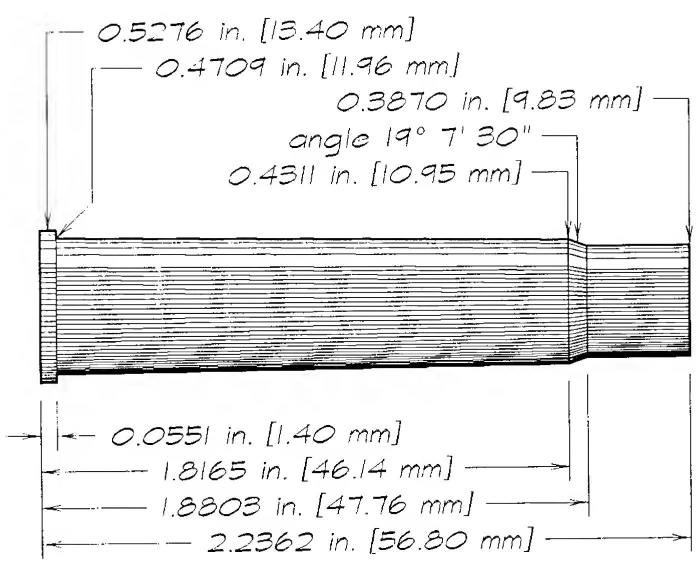
solid:
746 gr brass
88 gr water

.3575 bullet displaces
25.38 grains per inch.

Form from .30-06 Springfield or 8x57mm Mauser brass, in respective RCBS form die. Trim to 2¼ inches. Fire-form with inert filler. Trim to length and deburr.

9x57mm Rimmed

(CIP maximums)



solid:
749 gr brass
88 gr water

.357 bullet displaces
25.31 grains per inch.

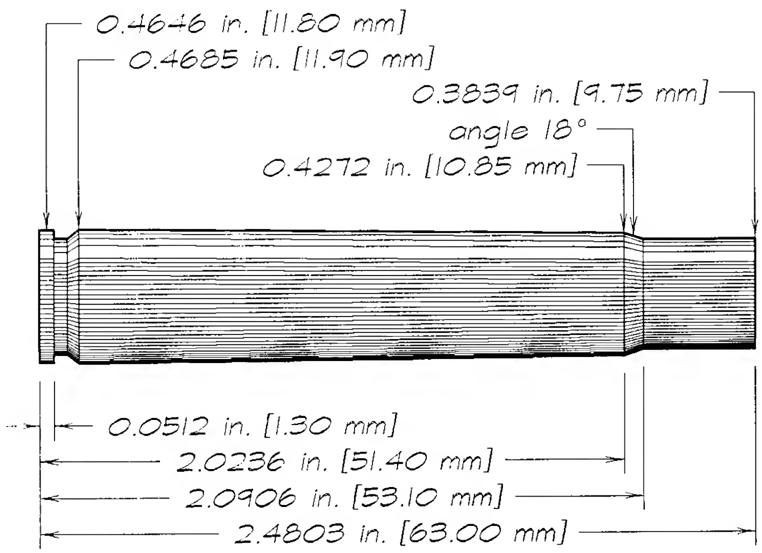
Use factory 9x57mm Rimmed brass. Or resize .444 Marlin brass in 9x57mm Rimmed sizer die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

9x63mm

(Triebel maximums)

solid:
819 gr brass
96 gr water



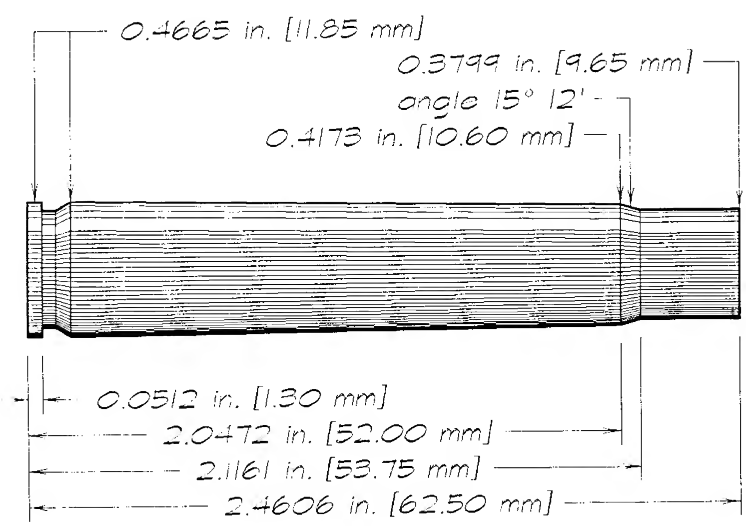
.357 bullet displaces
25.31 grains per inch.

Resize .35 Whelen brass full-length in 9x63mm sizer die. Fire-form with inert filler. Trim to 2.48 inches and deburr.

9x63mm Miller & Greis

(Triebel maximums)

solid:
802 gr brass
94 gr water



.356 bullet displaces
25.17 grains per inch.

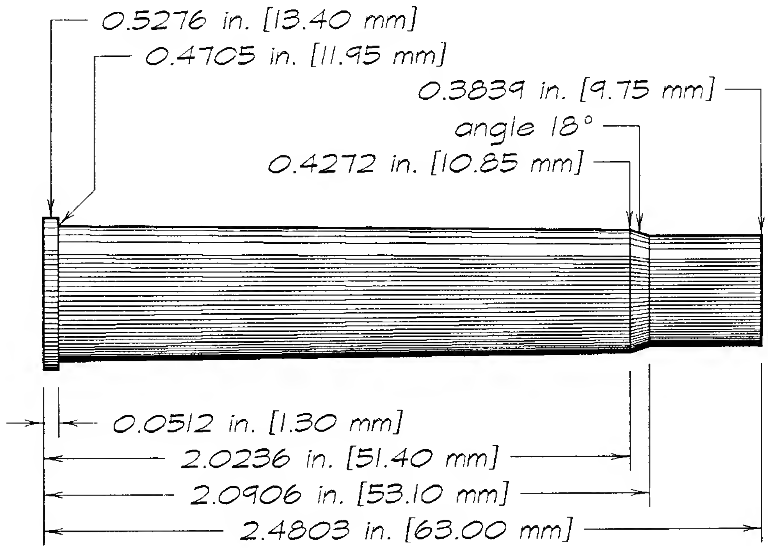
Resize .35 Whelen brass full-length in 9x63mm M&G sizer die. Fire-form with inert filler. Trim to 2.45 inches and deburr.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

9x63mm Rimmed

(Triebel maximums)

solid:
823 gr brass
97 gr water



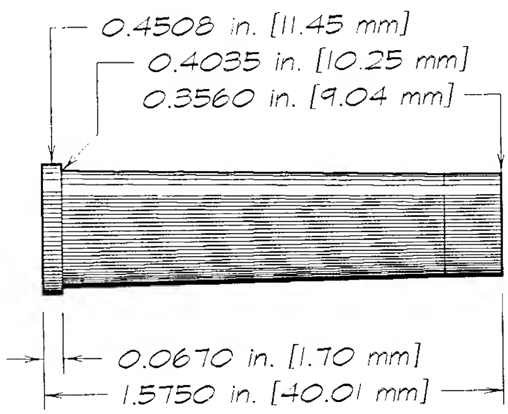
.357 bullet displaces 25.31 grains per inch.

Form from 9.3x74mm Rimmed brass, in RCBS form, trim, and ream dies.

9.1x40mm Rimmed

(Brno drawing, 1942)

solid:
393 gr brass
46 gr water



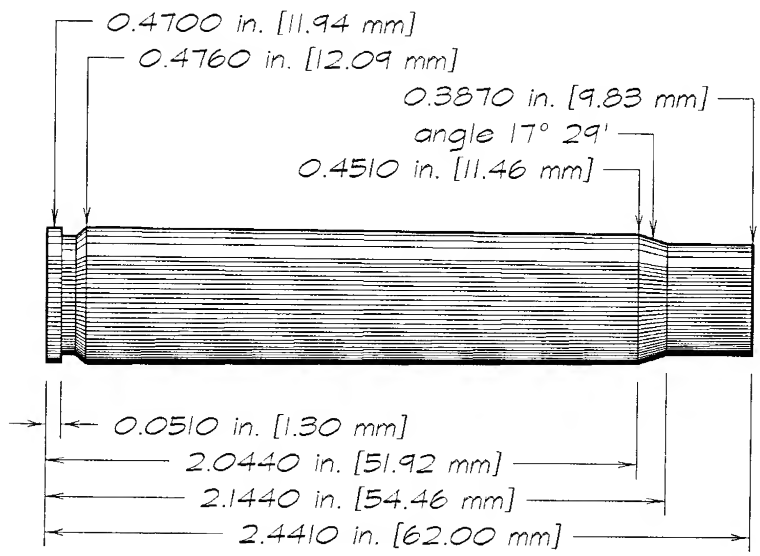
.358 bullet (?) displaces 25.46 grains per inch.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

9.3mm Mauser

(ICI Metals Ltd dwg)

solid:
851 gr brass
100 gr water



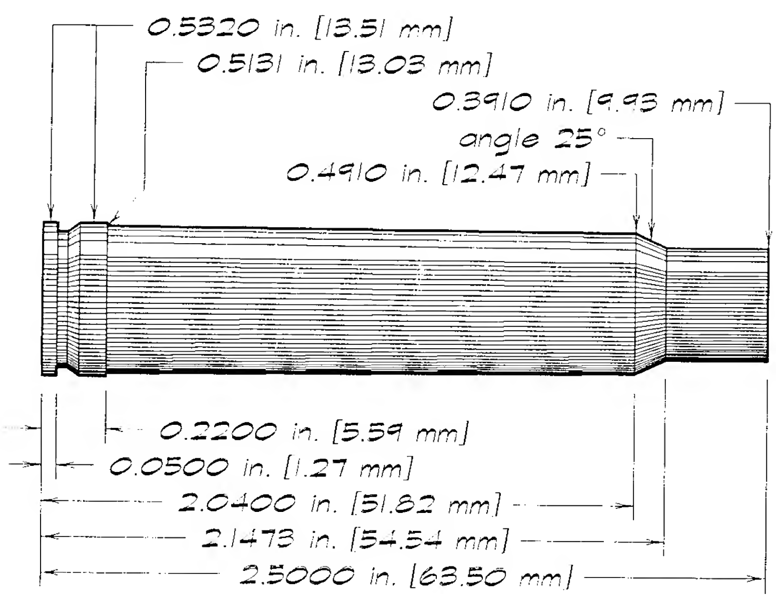
.365 bullet displaces
26.46 grains per inch.

Use 9.3x57mm Mauser brass. Or fire-form 8x57mm Mauser brass with inert filler. Or form from .30-06 Springfield brass, in RCBS form and trim dies.

9.3mm USA

(designer's specs)

solid:
1,032 gr brass
121 gr water



.366 bullet displaces
26.61 grains per inch.

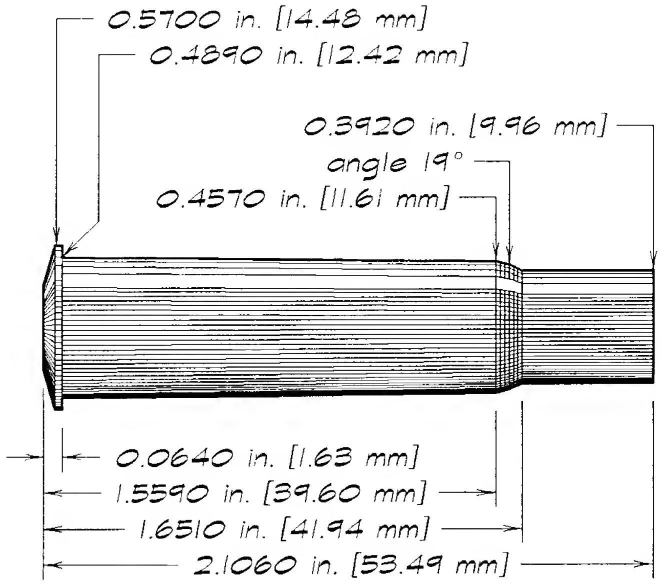
Fire-form .338 Winchester Magnum brass with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

9.3x53mm Rimmed (Finland)

(unfired specimen)

solid:
737 gr brass
86 gr water



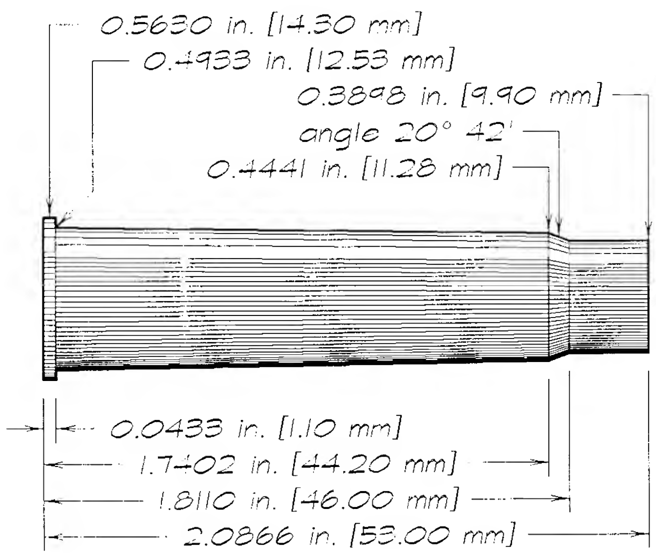
.366 bullet displaces
26.61 grains per inch.

Anneal neck and shoulder of 7.62 Russian brass. Fire-form with inert filler.

9.3x53mm Rimmed Swiss

(Triebel maximums)

solid:
746 gr brass
88 gr water



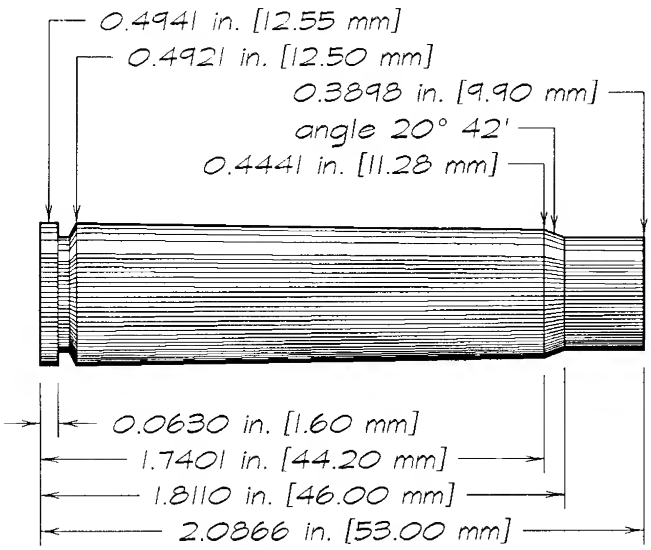
.364 bullet displaces
26.32 grains per inch.

Form from 7.62mm Russian brass, in RCBS form die. Fire-form with inert filler.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

9.3x53mm Swiss

(Triebel maximums)



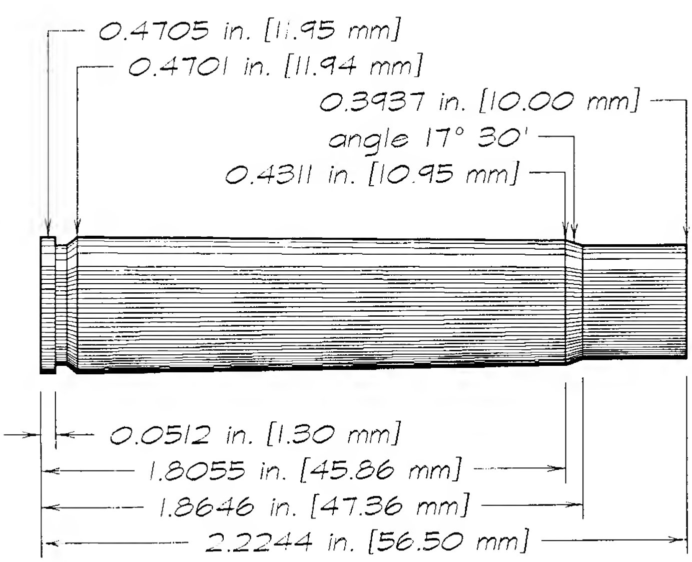
solid:
759 gr brass
89 gr water

.364 bullet displaces
26.32 grains per inch.

I don't know of any brass you can convert into this one.

9.3x57mm

(Triebel maximums)



solid:
742 gr brass
87 gr water

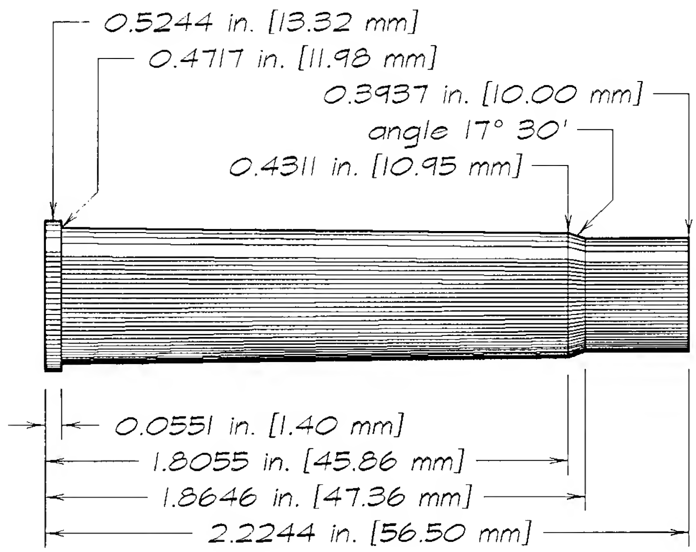
.364 bullet displaces
26.32 grains per inch.

Use factory 9.3x57mm brass. Or fire-form 8x57mm Mauser brass with inert filler.
Or form from .30-06 Springfield brass, in RCBS form and trim dies.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

9.3x57mm Rimmed

(Triebel maximums)



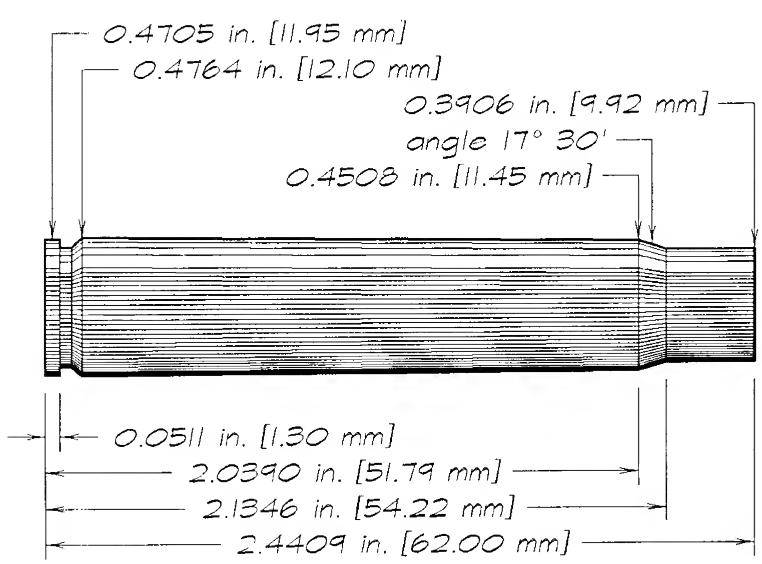
solid:
759 gr brass
89 gr water

.364 bullet displaces
26.32 grains per inch.

Form from .444 Marlin brass, in RCBS form and trim dies.
(Rim dimensions aren't right, so adjust form and sizer dies to headspace cartridge on shoulder instead of rim. Use .444 Marlin shellholder.)

9.3x62mm

(CIP maximums)



solid:
852 gr brass
100 gr water

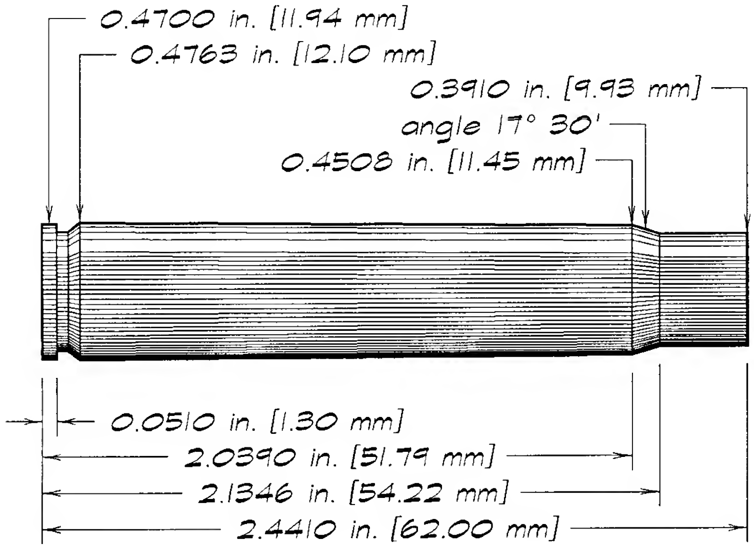
.366 bullet displaces
26.61 grains per inch.

Use factory 9.3x62mm brass. Or anneal neck and shoulder of .30-06 Springfield brass, then form and trim in RCBS 9.3x62mm form-and-trim die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

9.3x62mm Mauser

(RCBS drawing)



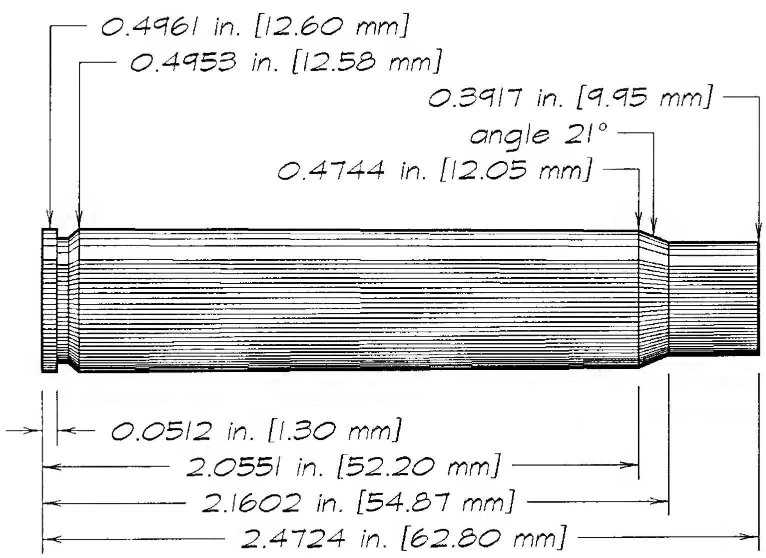
solid:
852 gr brass
100 gr water

.366 bullet displaces
26.61 grains per inch.

Form from .30-06 Springfield brass, in RCBS form die.

9.3x63mm

(Triebel maximums)



solid:
935 gr brass
110 gr water

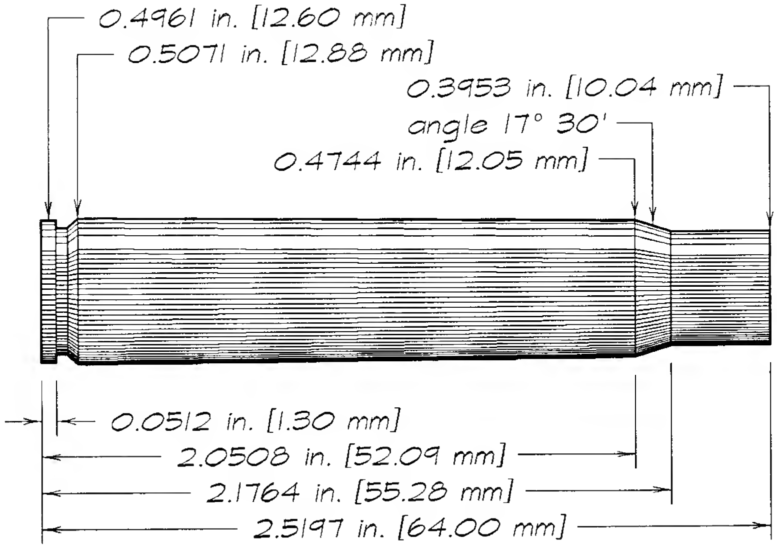
.366 bullet displaces
26.61 grains per inch.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

9.3x64mm Brenneke

(CIP maximums)

solid:
975 gr brass
114 gr water



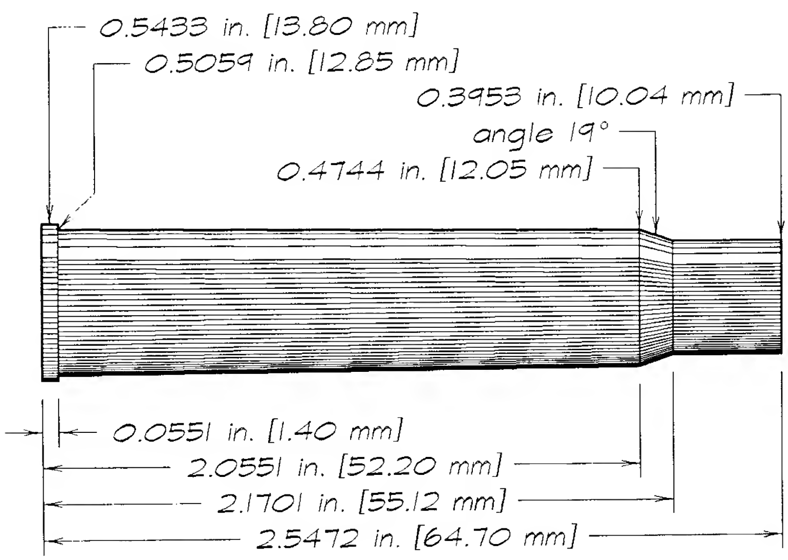
.366 bullet displaces 26.61 grains per inch.

Use factory 9.3x64mm Brenneke brass.

9.3x65mm Rimmed Brenneke

(Triebel maximums)

solid:
1,037 gr brass
122 gr water



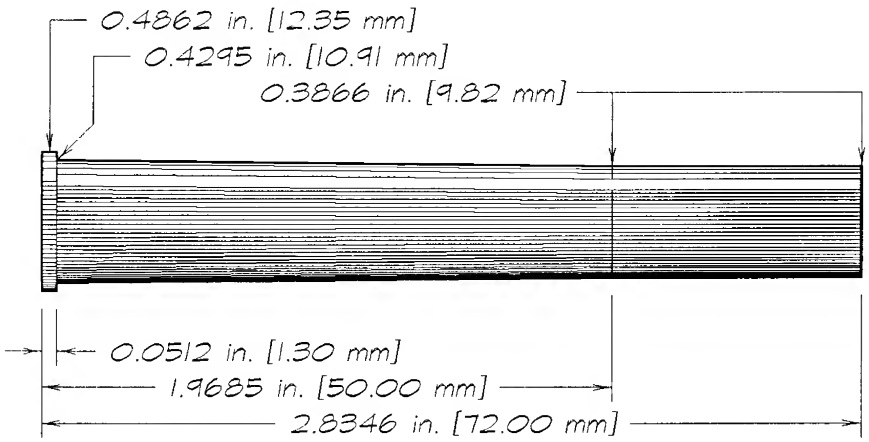
.366 bullet displaces 26.61 grains per inch.

Anneal forward 1½ inch of HDS .45 Basic brass, trim to 2.6 inches, and resize full-length in 9.3x65R sizer die. Trim to 2.54 inches and deburr.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

9.3x72mm Rimmed (CIP maximums)

solid:
793 gr brass
93 gr water

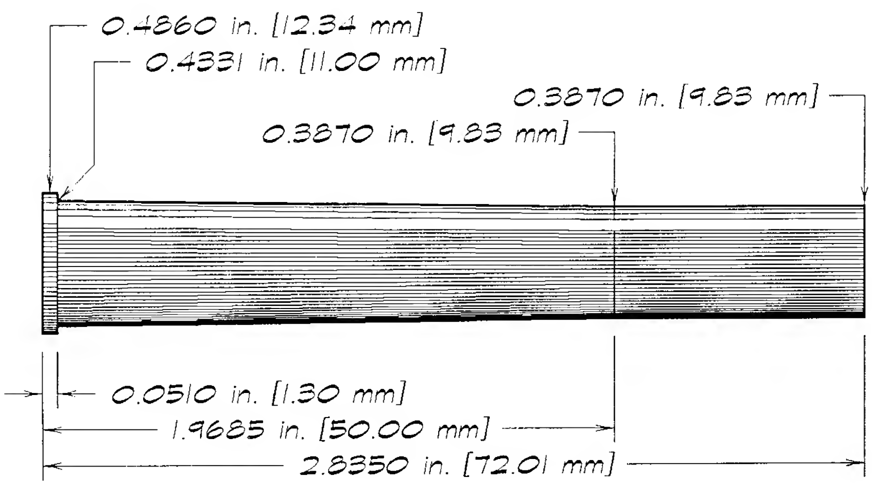


.377 bullet displaces
28.23 grains
per inch.

Use factory 9.3x72mm Rimmed brass. No satisfactory substitute exists.

9.3x72mm Rimmed (RCBS drawing)

solid:
801 gr brass
94 gr water



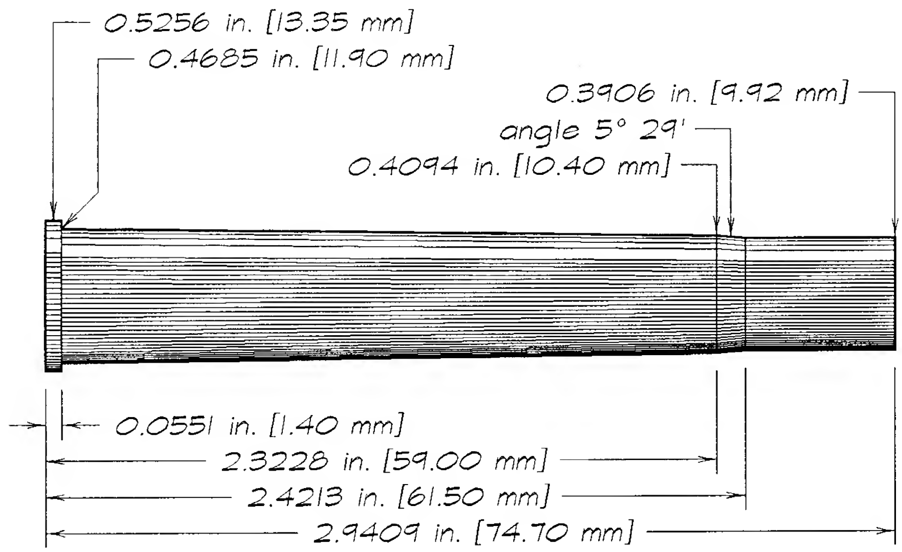
.377 bullet displaces
28.23 grains per inch.

Factory cases available. No substitute available.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

9.3x74mm Rimmed (CIP maximums)

solid:
950 gr brass
111 gr water

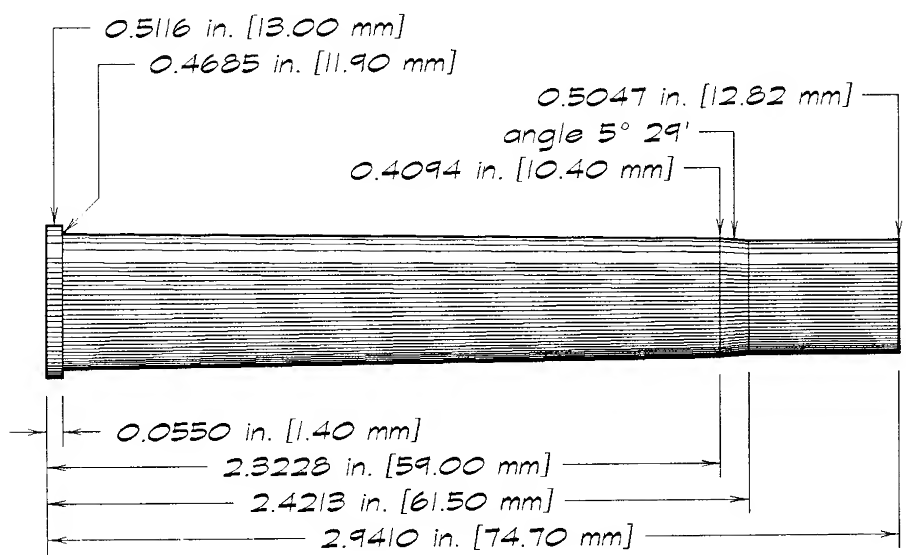


.366 bullet displaces 26.61 grains per inch.

Use factory 9.3x74mm Rimmed brass. No satisfactory substitute exists.

9.3x74mm Rimmed (RCBS drawing)

solid:
945 gr brass
111 gr water



.366 bullet displaces 26.61 grains per inch.

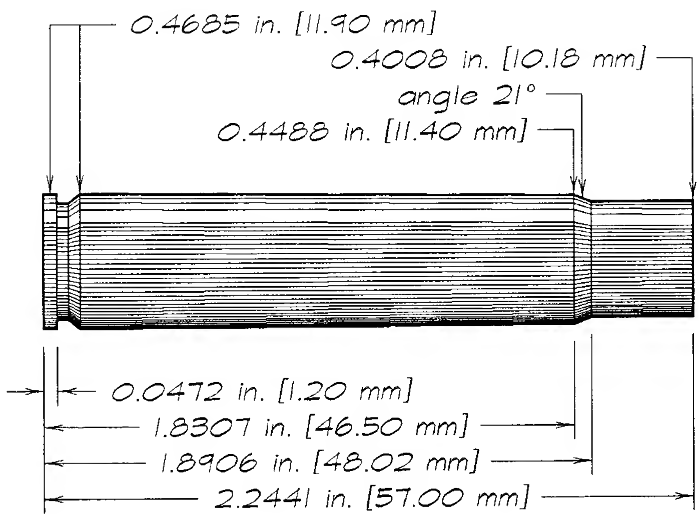
Factory brass available. No substitute available.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

9.5x57mm Mannlicher Schoenauer

(Triebel maximums)

solid:
764 gr brass
90 gr water



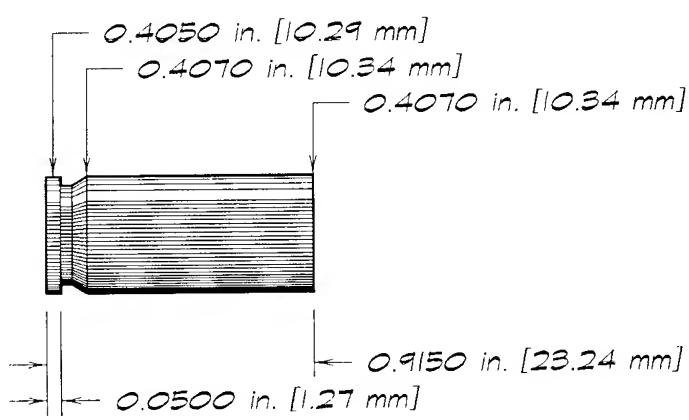
.378 bullet displaces
28.38 grains per inch.

Anneal neck and shoulder of .35 Whelen brass and resize full-length in body of 9.5x57mm MS sizer die (with decapper-expander removed) or RCBS form-and-trim die. Trim to 2.25 inches. Fire-form with inert filler. Trim to 2.24 inches and deburr mouths.

9.8mm Automatic (Colt)

(Winchester drawing, 1912)

solid:
246 gr brass
29 gr water



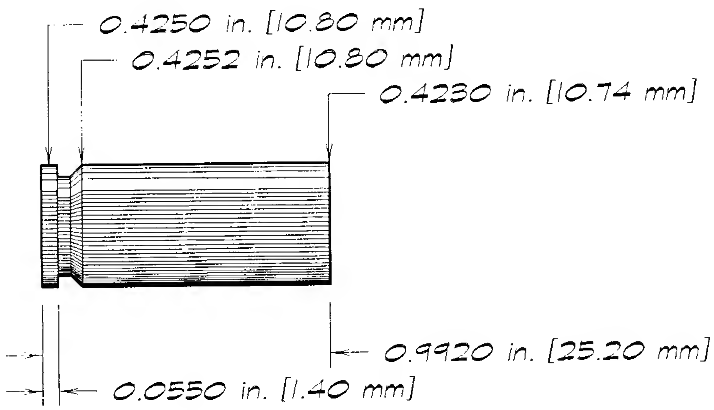
No substitute available for this one, as far as I know, but it may be possible to use a 9mm Winchester Magnum case (which is a hair too small) or a .22 Remington Jet case (which would take more work than most handloaders want to bother with).

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

10mm Automatic

(SAAMI maximums.)

solid:
290 gr brass
34 gr water



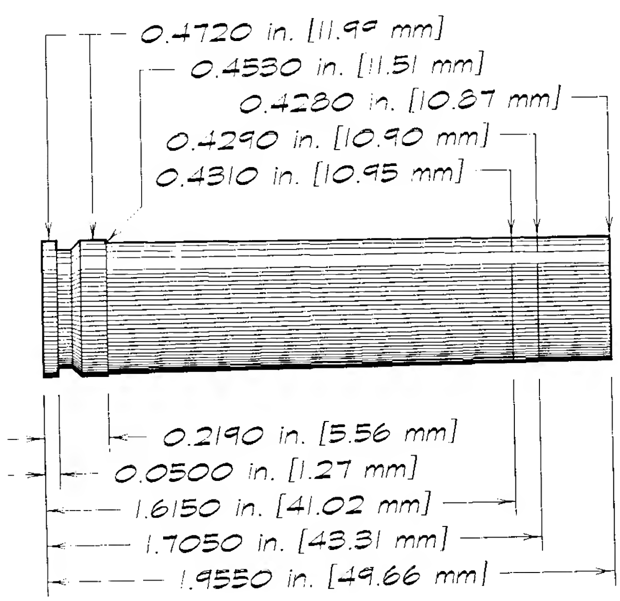
.400 bullet displaces
31.78 grains per inch.

Use factory 10mm Automatic brass. Or anneal upper body of .30 Remington case, trim to one inch long, and fire-form with inert filler. Then trim to 0.992 inch and deburr mouth.

Super 10mm Magnum

(designer's specs)

solid model:
673 gr brass
79 gr water



.400 bullet displaces
31.78 grains per inch.

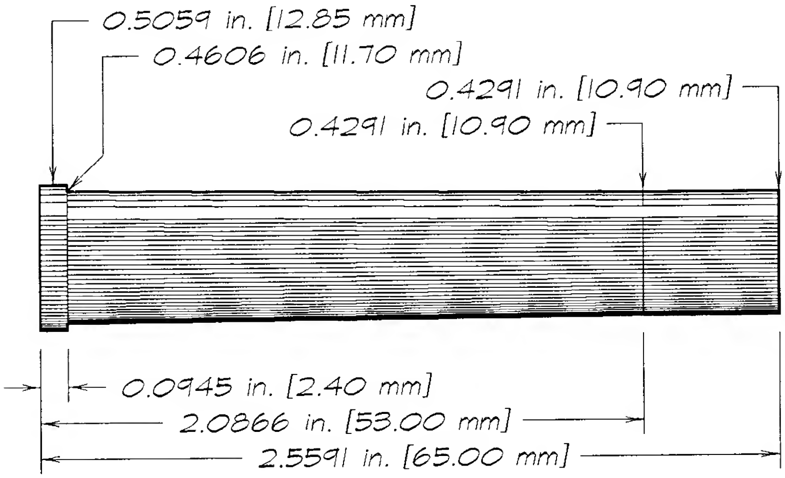
Anneal shoulder and upper body of .240 Weatherby Magnum brass. Trim to 2¼ inches. Fire-form with inert filler. Trim to 1.955 inch and deburr mouth.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

10.3x65mm Rimmed

(Triebel maximums)

solid:
883 gr brass
104 gr water



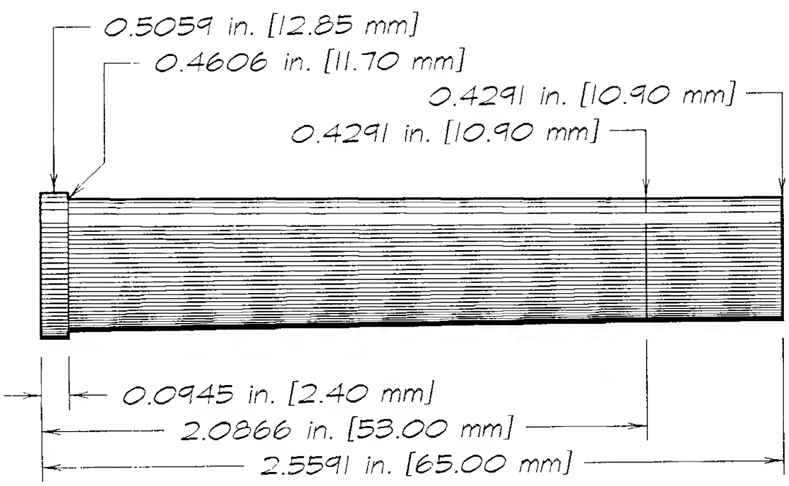
.423 bullet displaces
35.54 grains per inch.

Use recently manufactured 10.3x65R brass.

10.3x65mm Rimmed

(Triebel maximums)

solid:
883 gr brass
104 gr water



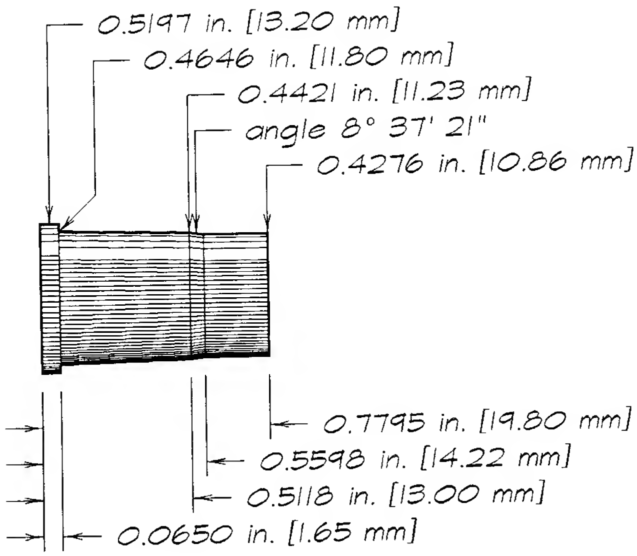
.423 bullet displaces
35.54 grains per inch.

Use recently manufactured 10.3x65R brass.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

10.4mm Italian Ordnance Revolver (Glisenti)

(CIP maximums)



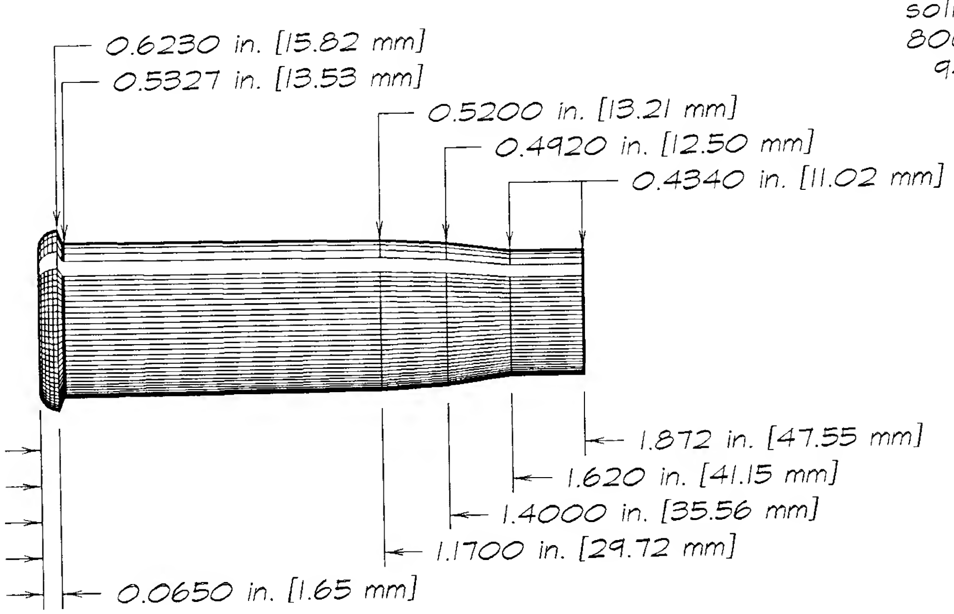
solid:
274 gr brass
32 gr water

.437 bullet displaces
37.93 grains per inch.

Use factory 10.4mm Ord. It. brass. Or trim .44 Special, .44 Magnum, or .44 Russian brass to 0.779 inch long. Size full-length in 10.4mm sizer die. Deburr.

10.4x48mm Rimmed Vetterlin (Italian gov't pattern)

(Kynoch drawing, 1884)



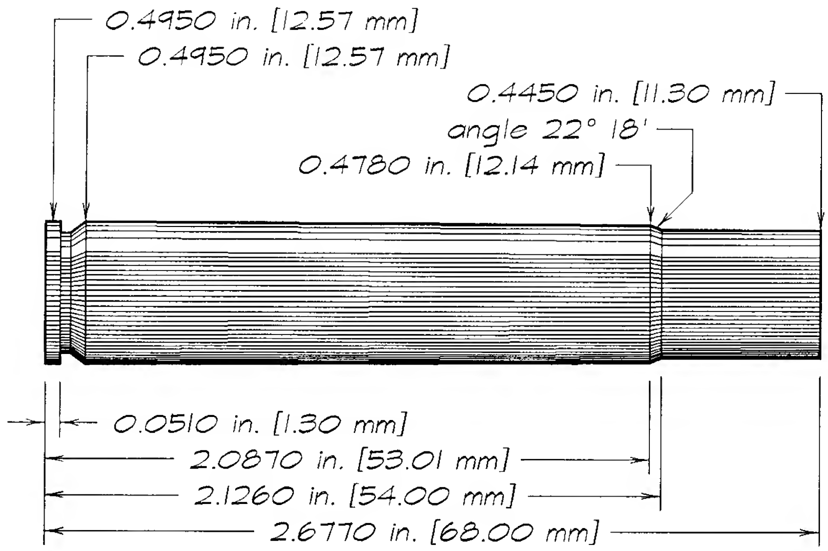
solid:
800 gr brass
94 gr water

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

10.75mm Mauser

(ICI Metals Ltd dwg)

solid:
1,042 gr brass
122 gr water



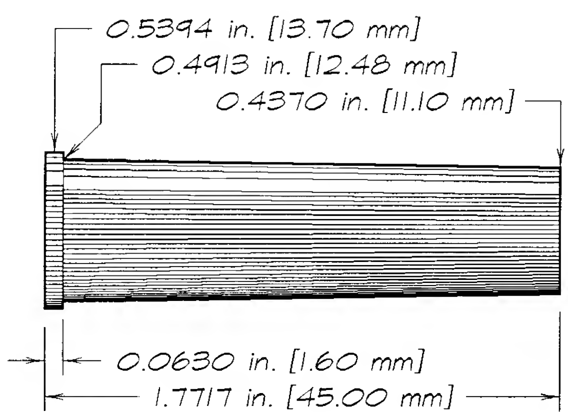
.422 bullet displaces
35.37 grains per inch.

Turn belt off .375 H&H Magnum brass. Anneal neck and shoulder. Expand neck with tapered expander or series of intermediate expanders. Form and trim in RCBS form and trim dies. Deburr.

10.75x45mm Rimmed

(Triebel maximums)

solid:
670 gr brass
79 gr water



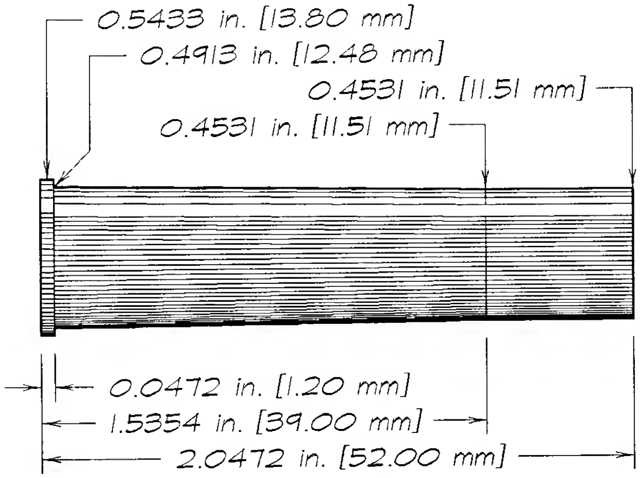
.423 bullet displaces
35.54 grains per inch.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

10.75x52mm Rimmed

(Triebel maximums)

solid:
775 gr brass
91 gr water



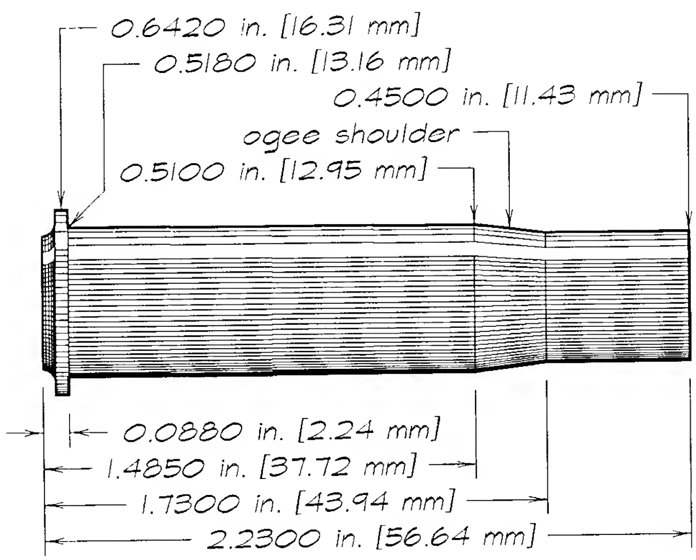
.423 bullet displaces
35.54 grains per inch.

Turn base of .45-90 Basic brass to 0.491 inch. Thin rim (from front, to keep from reducing depth of primer pocket) to 0.043 inch. Form in RCBS form-and-trim die.

10.75x58mm Rimmed Berdan (Russian gov't pattern)

(Kynoch drawing, 1884)

solid:
945 gr brass
111 gr water

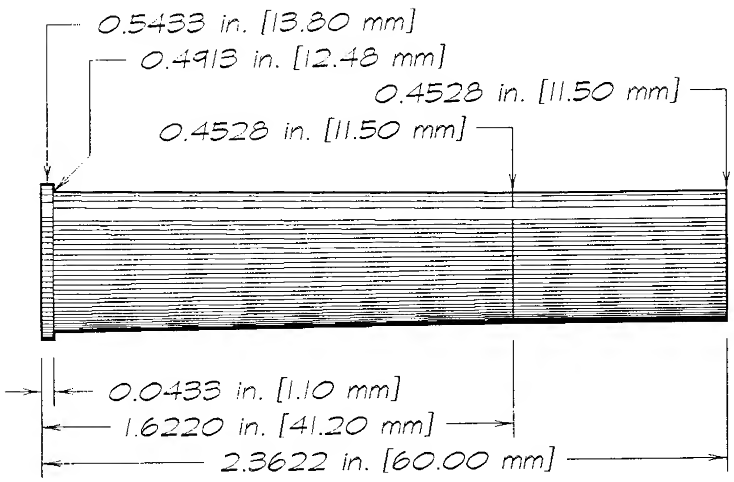


Anneal only by method shown in text. **Text explains use of "solid" and displacement figures.**

10.75x60mm Rimmed

(Triebel maximums)

solid:
885 gr brass
104 gr water



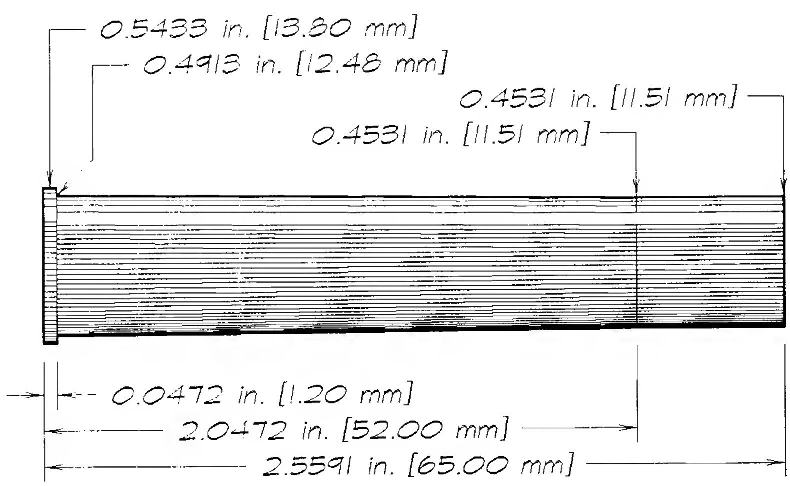
.423 bullet displaces
35.54 grains per inch.

Turn base of .45-90 Basic brass to 0.491 inch. Thin rim (from front, to keep from reducing depth of primer pocket) to 0.043 inch. Form in RCBS form-and-trim die.

10.75x65mm Rimmed

(Triebel maximums)

solid:
974 gr brass
114 gr water



.423 bullet displaces
35.54 grains per inch.

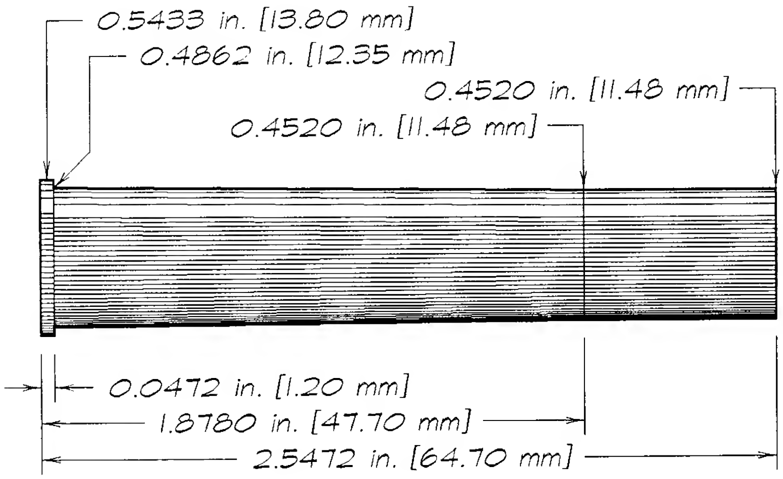
Turn base of .45-90 Basic brass to 0.491 inch. Thin rim (from front, to keep from reducing depth of primer pocket) to 0.047 inch. Form in RCBS form-and-trim die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

10.75x65mm Rimmed Collath

(Triebel maximums)

solid:
945 gr brass
111 gr water



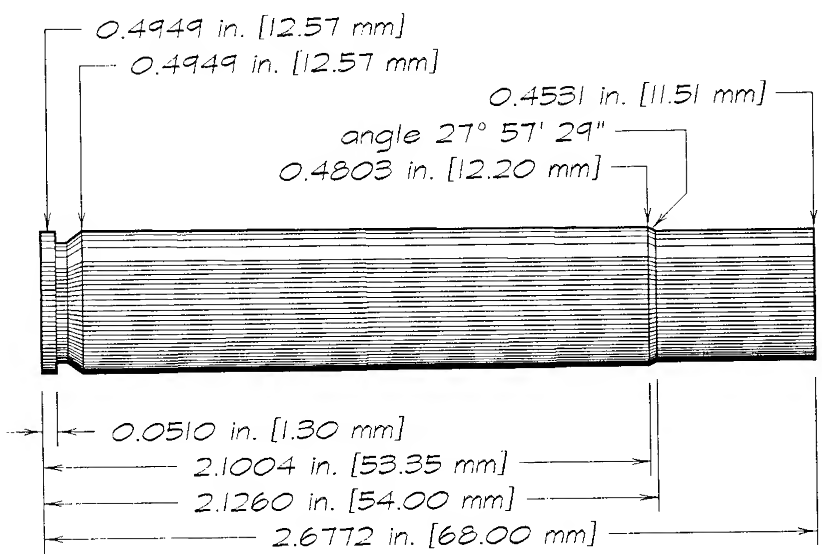
.423 bullet displaces 35.54 grains per inch.

Turn base of .45-90 2.6-inch Basic brass to 0.491 inch. Thin rim to 0.047 inch (from front, to avoid reducing depth of primer pocket). Form in RCBS form-and-trim die. Trim and deburr.

10.75x68mm

(CIP maximums)

solid:
1,049 gr brass
123 gr water



.424 bullet displaces 35.71 grains per inch.

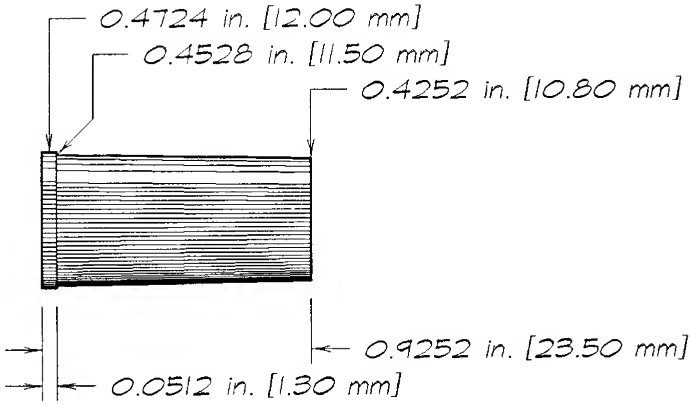
Turn belt off .375 H&H Magnum brass. Anneal mouth, shoulder, and upper body. Expand mouth and form in RCBS form-and-trim die. Fire-form with inert filler to expand body completely. Deburr.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

10.8mm Montenegrin No. 4

(Triebel maximums)

solid:
319 gr brass
37 gr water



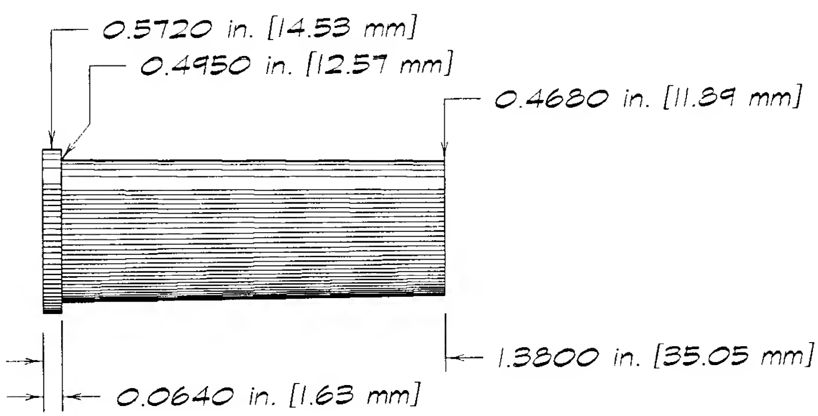
.425 bullet displaces
35.88 grains per inch.

Anneal upper body of recently manufactured 7mm H&H Magnum (a "flanged" case). Turn base to 0.452 inch. Thin rim (from front, to keep from reducing depth of primer pocket) to 0.051 inch. Form, trim, and ream in RCBS custom dies.

11mm Montenegrin

(Winchester drawing, 1911)

solid:
543 gr brass
64 gr water

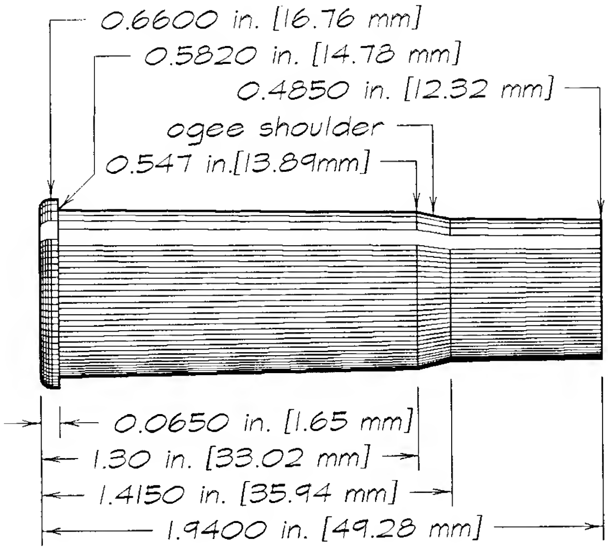


Use recently manufactured 11mm Montenegrin brass.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

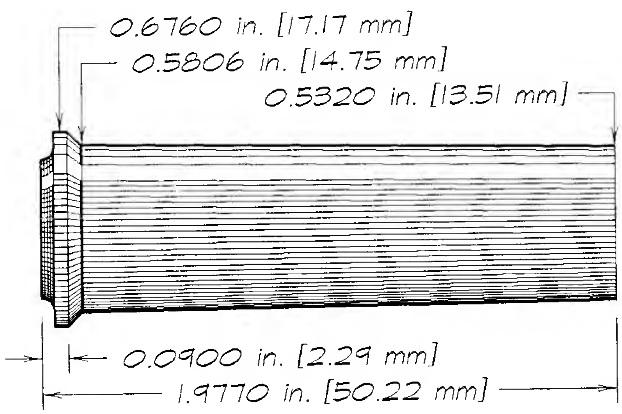
11x48mm Rimmed Remington (Egyptian gov't pattern) (Kynoch drawing, 1884)

solid:
990 gr brass
116 gr water



11x53mm Rimmed Comblain (Belgian gov't pattern) (Kynoch drawing, 1884)

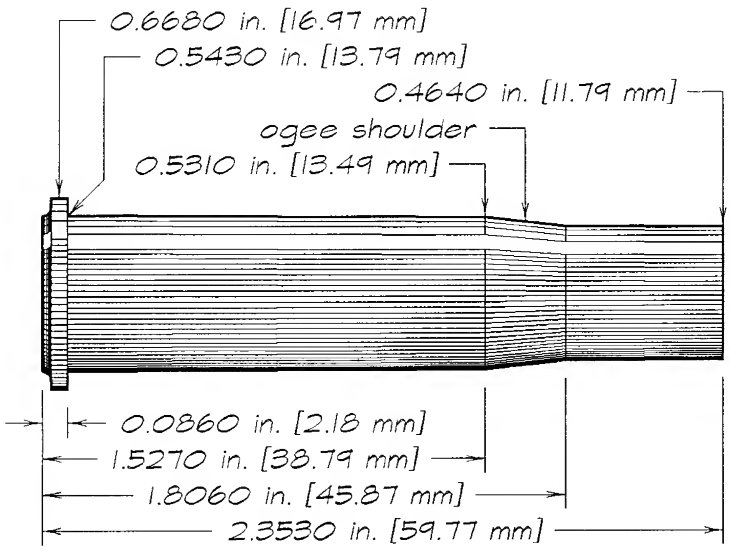
solid:
1,049 gr brass
123 gr water



Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

11x59mm Rimmed Gras (French gov't pattern)

(Kynoch drawing, 1884)

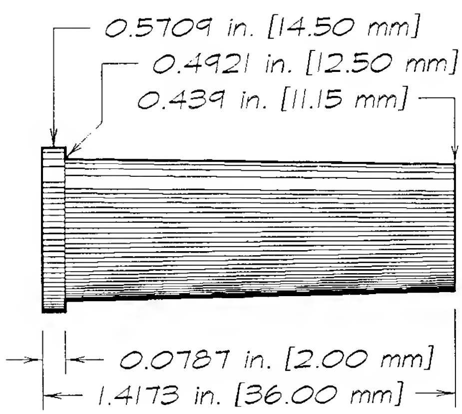


solid:
1,082 gr brass
127 gr water

.416 bullet displaces
34.37 grains per inch.

11.15mm Montenegrin No. 2

(Triebel maximums)



solid:
535 gr brass
63 gr water

heeled bullet

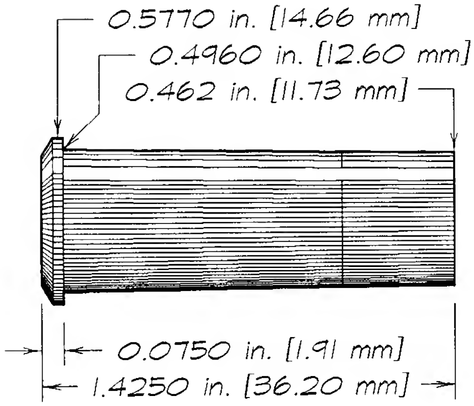
Anneal upper body of HDS .45 Basic brass. Turn base to 0.492 inch. Turn rim to 0.570 inch. Form in RCBS form, trim, and ream dies. Deburr.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

11.15x36mm Rimmed

(Brno drawing, 1942)

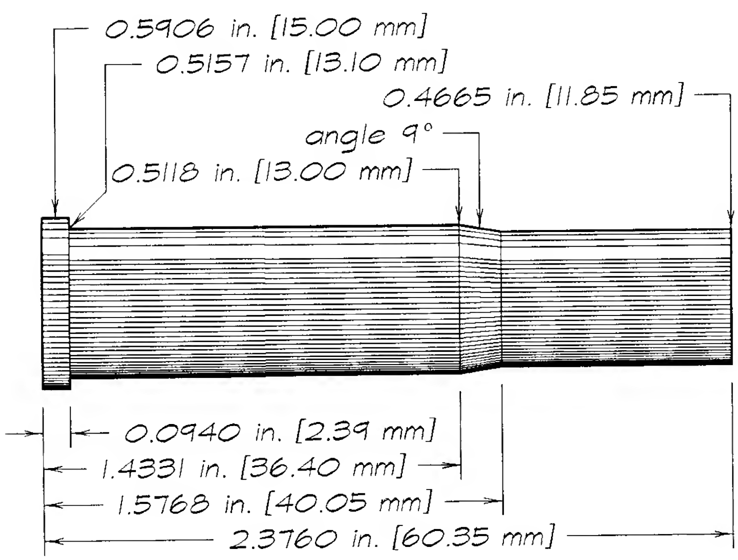
solid:
554 gr brass
65 gr water



11.15x60mm Rimmed

(CIP maximums)

solid:
1,052 gr brass
123 gr water



.449 bullet displaces
40.04 grains per inch.

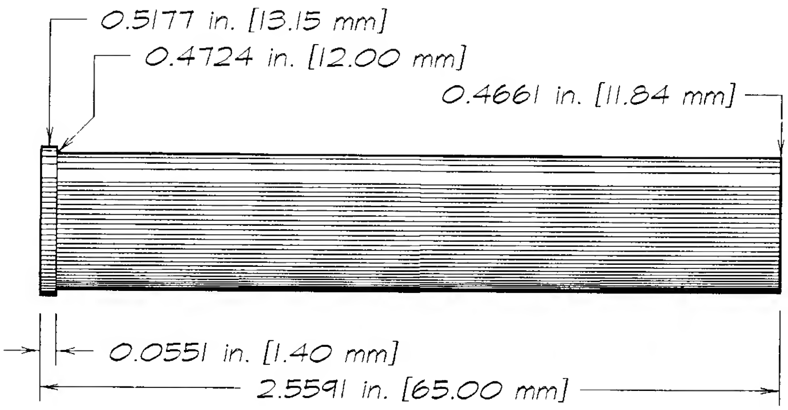
Use factory 11.15x60mm Rimmed brass. Or form from .43 Mauser Basic brass, in RCBS form die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

11.15x65mm Rimmed Express

(Triebel maximums)

solid:
1,026 gr brass
120 gr water



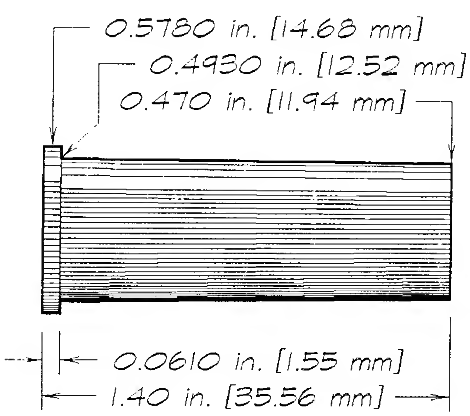
.446 bullet displaces
39.51 grains per inch.

Anneal neck and shoulder of 9.3x74mm Rimmed brass. Trim to 2.6 inches. Fire-form with inert filler. Trim to 2.55 inches. Deburr.

11.2x36mm Rimmed Werndl Model 1867
(Austrian government pattern)

(Kynoch drawing, 1884)

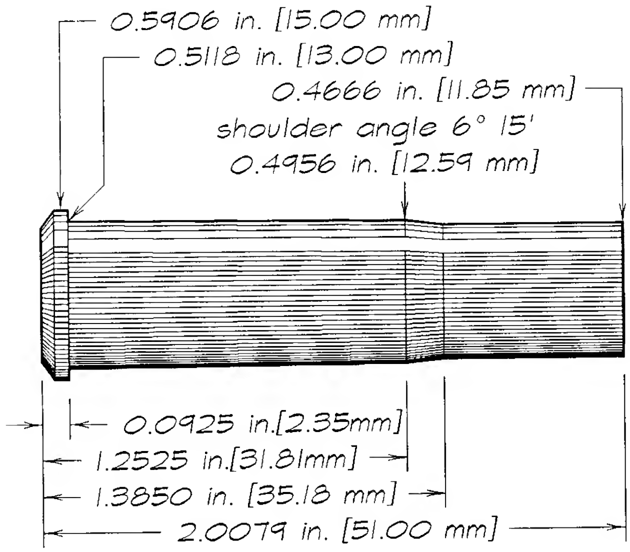
solid:
549 gr brass
64 gr water



Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

11.2x51mm

(Brno drawing, 1942)

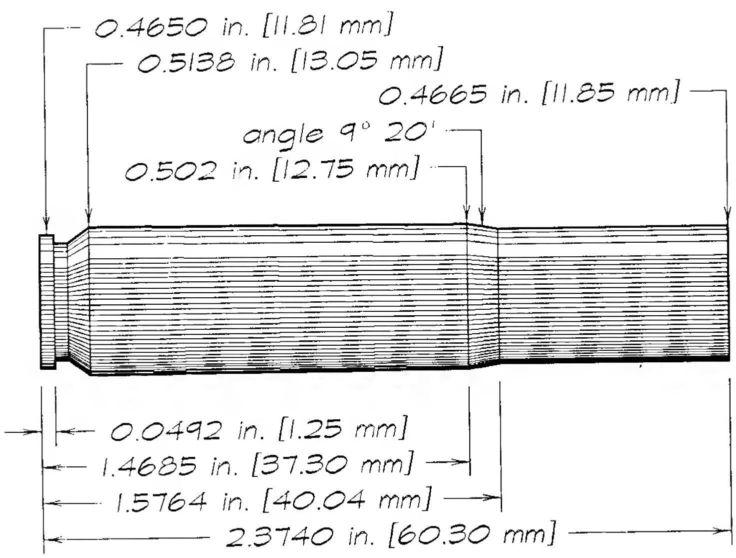


solid:
834 gr brass
98 gr water

.441 bullet (?) displaces
38.63 grains per inch.

11.2x60mm Mauser (Schuler)

(Triebel maximums)



solid:
981 gr brass
115 gr water

.441 bullet displaces
38.63 grains per inch.

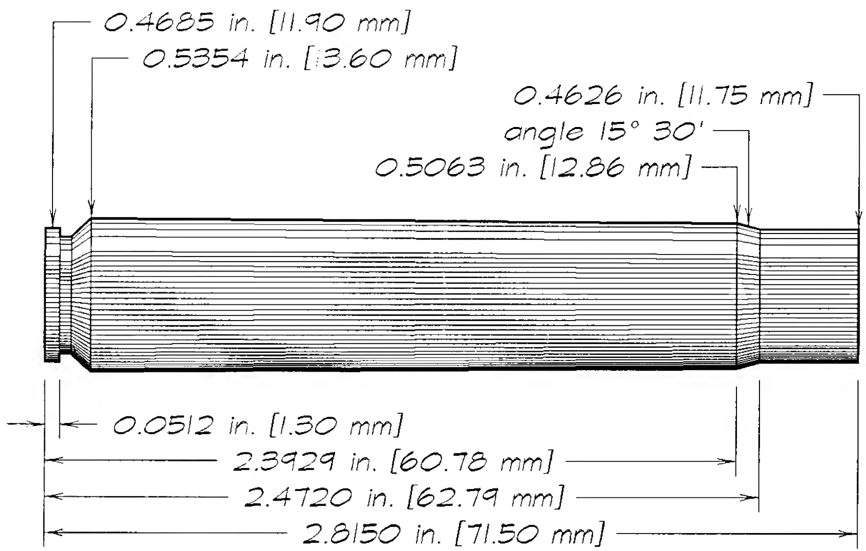
Turn rim of recently manufactured .450 Basic brass. Recut extractor groove.
Form and trim in RCBS form-and-trim die. Deburr.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

11.2x72mm Schuler

(Triebel maximums)

solid:
1,248 gr brass
146 gr water



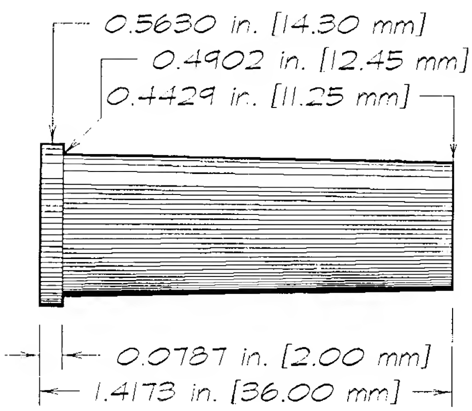
.441 bullet displaces
38.63 grains per inch.

Turn rim of recently manufactured .450 Basic brass. Recut extractor groove.
Form and trim, in RCBS form-and-trim die. Deburr.

11.25mm Montenegrin No. 3

(Triebel maximums)

solid:
536 gr brass
63 gr water



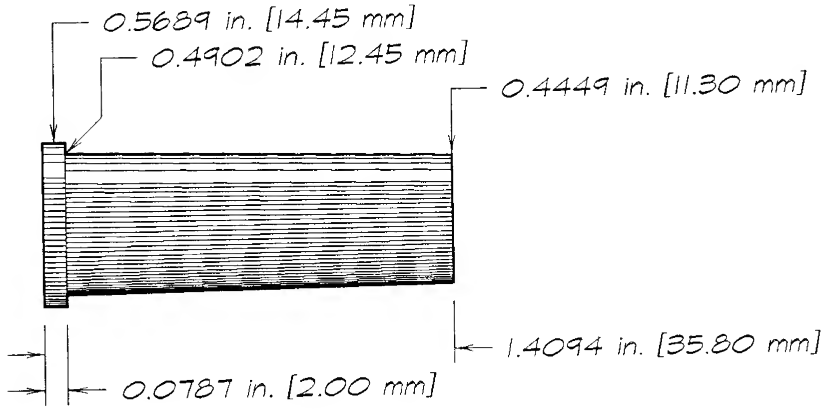
.442 bullet displaces
38.80 grains per inch.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

11.3mm Montenegrin No. 1

(Triebel maximums)

solid:
534 gr brass
63 gr water

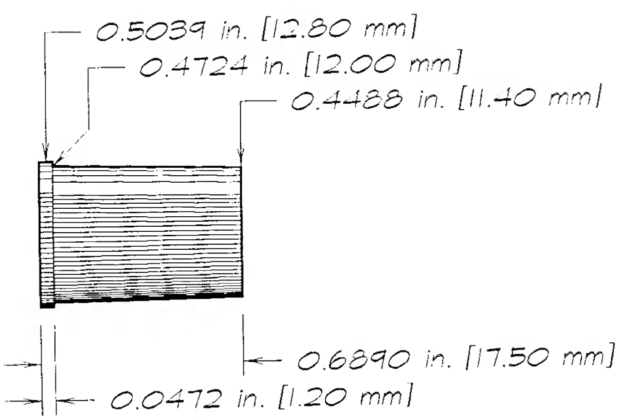


.442 bullet displaces
38.80 grains per inch.

11.4mm Montenegrin No. 5

(Triebel maximums)

solid:
267 gr brass
31 gr water



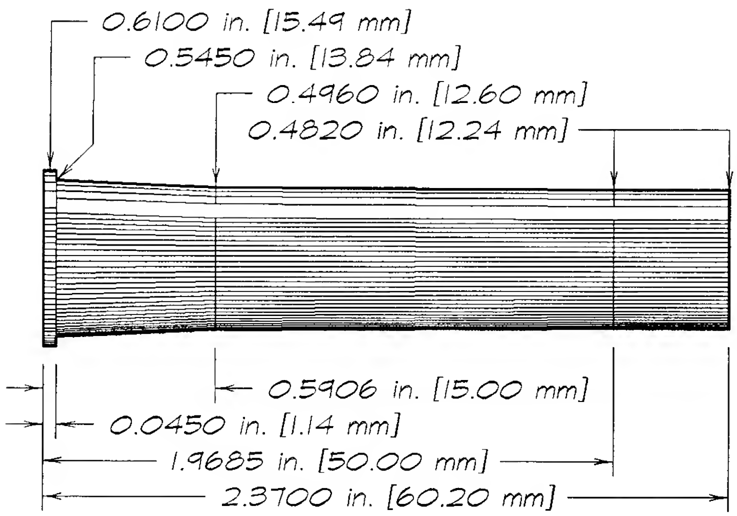
Anneal upper body of recently manufactured .400 NE Basic brass. Trim to 0.689 inch. Slug bore to determine appropriate bullet diameter; ream inside case mouth, in RCBS ream die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

11.6x60 Rimmed

(Brno drawing, 1942)

solid:
1,018 gr brass
119 gr water

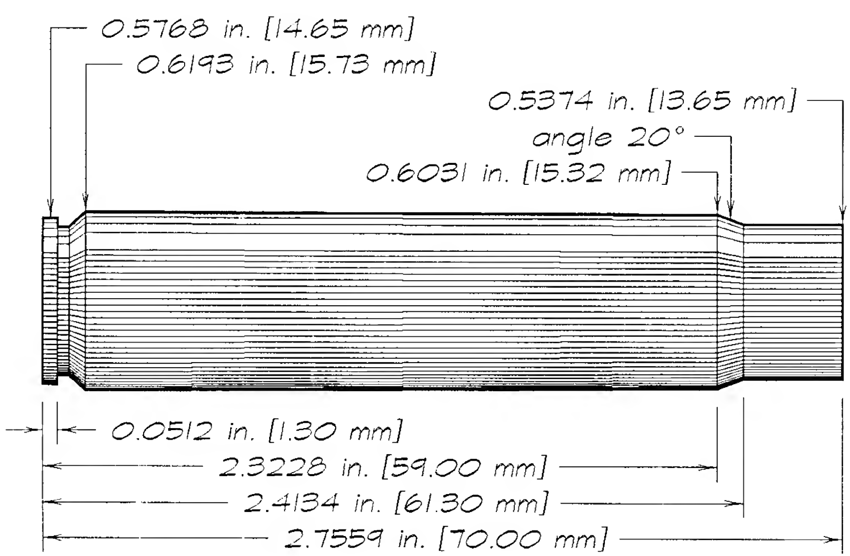


.457 bullet displaces
41.48 grains per inch.

12.5x70mm Schuler

(Triebel maximums)

solid:
1,679 gr brass
197 gr water



.508 bullet displaces
51.26 grains per inch.

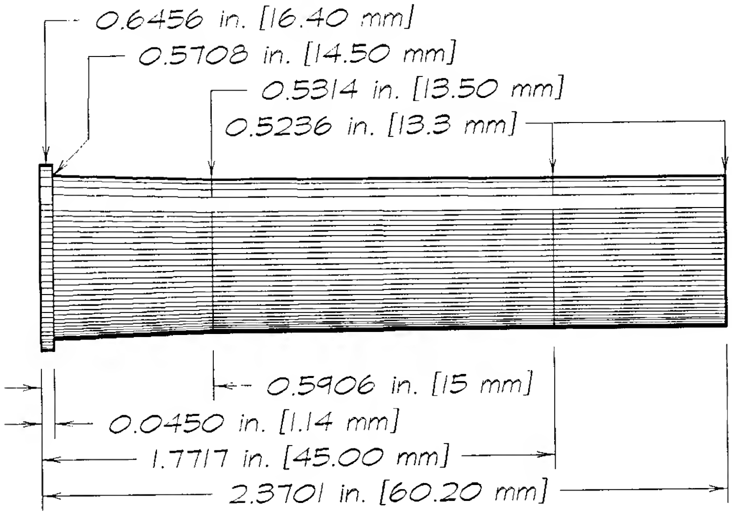
Use recently manufactured 12.5x70 brass. Or form from .505 Gibbs Basic brass, in RCBS form die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

12.7x60mm Rimmed

(Brno drawing, 1944)

solid:
1,152 gr brass
135 gr water

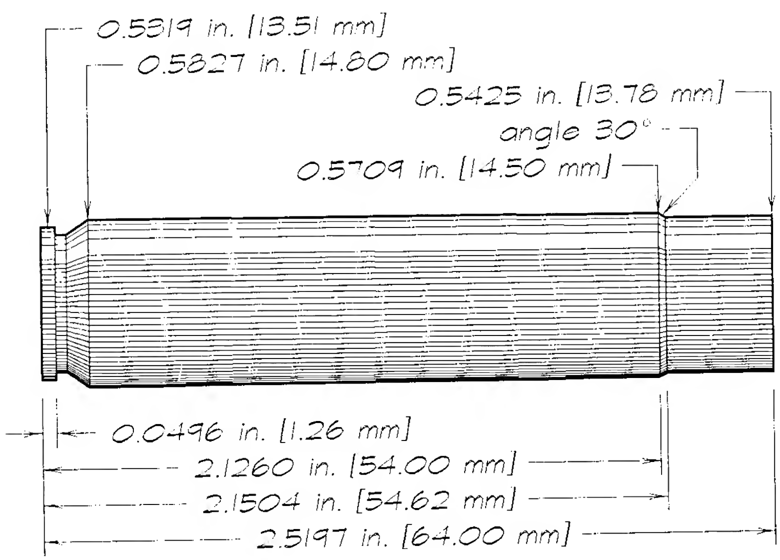


.500 bullet (?) displaces 49.65 grains per inch.

12.7x64mm HK (.500 HK)

(Heinz Krenn drawing)

solid:
1,384 gr brass
162 gr water



.511 bullet displaces 51.86 grains per inch.

Anneal neck and upper shoulder of .416 Rigby brass. Expand mouth and form case in RCBS form-and-trim die.

Anneal only by method shown in text. Text explains use of "solid" and displacement figures.

Chapter 7

Get other stuff somewhere else.

I KNOW — your interest in cartridges feeds on other information besides just case dimensions, parent cases, and how to make one case work in another cartridge's chamber. If you're a cartridge collector, you're probably disappointed that I haven't included headstamps or historical notes for any cartridge I've drawn, but the absence of load data doesn't bother you at all. If you're a handloader, you probably wish these pages included dependable load data for your favorite factory and wildcat cartridges and don't give a hoot about the absence of the material the collectors want.

More than a few good references can feed your other interests, and others like them will no doubt show up. By no means am I the only writer who's working on cartridge books. Just about anything you want to know about cartridges in general or a certain cartridge in particular (a) is likely to exist now in the pages of some book that's already in print or (b) will soon exist in some book that's now or will soon be in the works — books, you can be sure, by writers who know worlds more than I know about these other rich fields of cartridge knowledge.

So I hope you'll forgive me for not trying to touch on every prominent cartridge interest, and will look to other sources for your loading tools and supplies, your brass, load data, and other cartridge information.

Cases, Dies, Equipment

Far longer than anyone else, and more than anyone else, RCBS has catered to the special needs and interests of handloaders who need special dies for all phases of forming and loading cases for custom cartridges. Like most other handloaders, I think first of the RCBS custom-die shop when the need arises for special dies. More recently, Richard Beebe at Redding has tooled up to turn out custom dies for loading cartridges that are in some way out of the ordinary — wildcat, exotic, obsolete. Redding quality is beyond reproach, but RCBS has simply been making custom dies far too long for anyone else — no matter how well capitalized — to tool up and make a comparable variety of custom dies. Redding also makes the superb SAECO line of bullet moulds.

RCBS, Division of Blount, Inc; 605 Oro Dam Boulevard; Oroville, California 95965; (800) 533-5000; (916) 533-5191

Redding Reloading Equipment; 1089 Starr Road; Cortland, New York 13045; (607) 753-3331.

When Omark bought RCBS from the Huntingtons, the family kept the retail sporting-goods store next-door to RCBS in Oroville. The Huntingtons also staved off the threat that the buyer might shut down the custom-die shop as too costly an operation. The Huntingtons said, in

essence, "Keep making all the custom dies, and we'll handle the chores and expenses of marketing them for you." So out of long- and well established trust and habit, I go to Huntington Die Specialties (HDS) first for specialty dies. Huntington's also contracts with case makers to make special runs of custom HDS brass, and stocks quantities of those case makers' regular brass — from Bertram in Australia and A-Square in the United States, as well as the usual lines of American and European brass. Bertram alone, for example, makes cases for these old-time cartridges (get 'em from Huntington's):

.222 Rimmed
.240 Belted
.240 Flanged
.25-20 Single-Shot
.25-21 Stevens
.25-25 Stevens
.28-30 Stevens
.30-30 Basic 3-1/4-Inch
.280 Flanged
.30 Mauser
.30 Super
.300 Rook
.300 Sherwood
.310
.310 Cattle Killer
.318 Rimless
.32 Ideal
.32 Winchester Self-Loading
.33 Winchester
.333 Flanged
.350 Rigby Magnum
.360 Nitro
.360 Number 2
.375 Flanged
.375 Magnum
.375 Magnum Basic
.38-56
.38-72
.40-65
.40-70 Sharps
.40-72
.40-82
.40-90 Sharps
.400 Nitro 3-Inch
.400-.350
.400-.360 (thick Westley Richards rim)
.400-.360 (thin Purdey rim)
.400-.375 Belted
.404
.405 Basic 3-1/4-Inch
.405 Winchester
.41 Long Colt
.425 Westley Richards
.43 Mauser
.43 Spanish
.45 Basic 2.6-Inch
.45 Basic 3-1/4-Inch
.45-90
.450 Basic, thick rim
.450 Basic, thin rim
.450-.400 3-Inch
.50 Sharps 3-1/4-Inch
.50-70
.50-110 Winchester
.500 Basic 3-1/4-Inch
.500 Jeffery
.500 Number 2
.505 Gibbs
.577-.450
.577-.500 Basic 3-1/8-Inch
.577 Basic 3-Inch
.577 Basic 3-1/4-Inch
.600 Nitro
.600-.577 REWA
5.6mm vom Hofe
5.6x33mm Rimmed
6.5x58mm Rimmed
7mm Holland & Holland
7mm Rigby
7x33mm Sako
7x72mm Rimmed
7.5mm Nagant
7.62mm Nagant
7.65mm MAS
8mm Nagant
8x56mm Rimmed Hungarian
8x58mm Rimmed
8x58mm Rimmed Danish
8x64mm S
9mm Basic
9.3x82mm Rimmed
9.5x47mm Rimmed
10.3x65mm Rimmed Baenziger
11.15x58mm Rimmed Werndl M77
11.75mm Montenegrin

The HDS catalog lists the full RCBS line of tools, including spare and replacement parts, plus a good many other goodies for handloaders — making HDS a "one-stop" source for handloading equipment and supplies. **Huntington's Die Specialties**; P O Box 991 (601 Oro Dam Blvd); Oroville, California 95965; (916) 534-1210

The Dillon Super Swage 600 is a separate tool specifically and only for swaging the crimp out of the primer pockets of military cases. This tool combines inside support for the case, a hardened tool-steel swager punch, and a compound lever to — they say — "swage the primer pockets with speed and ease.... No reaming is necessary." Catalog Number CC-20095. **Dillon Precision Products, Inc**; 7442 East Butherus Drive; Scottsdale, Arizona 85260- 2415

Bruce Hertzler, at **Sandia Die & Cartridge**; 37 Atanacio Road; Albuquerque, New Mexico 87123; (505) 298-5729 makes an ingenious drill-press accessory for cutting large quantities of cases to length (a tool for mass production, not inexpensive unless quantities to be cut to length are large) and other devices for high-volume case-conversion operations, including newly designed special-purpose devices for your particular needs.

The chamber-casting alloy Cerrosafe is a "must" among the regular necessities of anyone who encounters odd or unique chambers. This bismuth alloy melts at a mere 158° to 190° Fahrenheit, is endlessly reusable, and shrinks and swells at minute, known rates. Make a Cerrosafe cast of your chamber or bore, pack it carefully with a note that it's a Cerrosafe cast, and any custom-die maker will know how accurate it is and will be able to make the dies to fit your cases to your chamber. **Brownell's, Inc**; 200 South Front Street; Montezuma, Iowa 50171; (515) 623-5401.

Brownell's sells a selected assortment of chambering reamers made by Clymer (a brand I've never used, for no special reason) — most of the old standards and some wildcats — but for a wider selection of in-stock reamers and headspace gauges, or to have reamers and gauges made for your own cartridge, get in touch with Jim Cuthbert at **JGS Precision Tool Mfg**; 1141 South Sumner Road; Coos Bay Oregon 97420; (503) 257-4331, or Hugh Henriksen at **Henriksen Tool Company, Inc**; 8515 Wagner Creek Road; Talent, Oregon 97540; (503) 535-2309.

When you get your Volume Two of *Custom Cartridges*, you're going to want one of Homer Powley's ingenious little slipsticks for calculating moderate-pressure starting loads, and you might as well get it now. (Shame on you if you're a handloader and don't have one already.) It's called the Powley Computer for Handloaders. **Hutton Rifle Ranch**; P O Box 45236; Boise, Idaho 83711; (208) 345-8781. (Alas, this outfit is no longer run by the late Bob Hutton, but his successors worked for Bob during his last years and continue with the same old business in the same old way at this new address.)

McMaster-Carr Supply Company is a huge industrial supplier, *the place* to get an arbor press for the most drastic case-formings (a few of the special RCBS form-die sets require an arbor press) and the welder's temperature-sensitive crayons used in my annealing system. McMaster-Carr is also an incomparable source for more shop and factory goodies than you'd think one outfit could keep track of — four outlets:

- 9630 Norwalk Boulevard: **Santa Fe Springs, California** 90670-2932; (213) 692-5911; mail address P O Box 54960; Los Angeles, California 90054-0960
- Monmouth Junction Road; **Dayton, New Jersey** 08810-0317; (908) 329-3200
- 6100 Fulton Industrial Boulevard; **Atlanta, Georgia** 30336-2852; (404) 346-7000
- 600 County Line Road; **Elmhurst, Illinois** 60126-2081; (708) 833-0300

Lee Precision, Inc (4275 Highway U; Hartford, Wisconsin 53027) makes the simple little case trimmer that I use two parts of (the locking stud and shell holder) in my annealing setup (Chapter 4).

Bulletmaking Equipment

I haven't gone into custom bullets, another field of endeavor for truly and *completely* custom cartridges. The old familiar lines of bullet moulds from Lyman, RCBS, and SAECO (now Redding) are of course still available from these well established sources. NEI moulds are again

dependably available under a slightly different new ægis. **NEI Handtools, Inc** (51583 Columbia River Highway; Scappoose, Oregon 97056; (503) 543-6776) is back in business under the recovered ownership of the founder, Walt Melander, after a disastrous temporary transfer of ownership to people who apparently didn't quite know how to make and market bullet moulds commercially. Walt is doubly busy, making the astonishingly huge variety of NEI moulds and rebuilding the bridges of goodwill and satisfaction between NEI and his customers.

For years, Walt made cherries for new cast-bullet sizes, styles, and designs his customers asked for — and I assume that now or later he will again add new moulds as readily as he did in The Good Old Days.

Cartridge Books

Several of the best cartridge books are out of print, and even the current ones can be hard to find (usually impossible at municipal libraries, B Dalton, and Waldenbooks). Huntington's (above) keeps a good selection in stock, and several good outfits specialize in gun books. The best-known, probably the oldest and biggest, is **Ray Riling Arms Books Company**; P O Box 18925 (6844 Gorsten Street); Philadelphia, Pennsylvania 19119; (215) 438-2456; new and used books on guns, hunting, history, handloading, military, ballistics, collecting, edged weapons; Joe Riling.

Brownell's, Inc (200 South Front Street; Montezuma, Iowa 50171; (515) 623-5401) is *the* American source for gunsmiths' goodies and stocks a rich variety of gun books, including not only gunsmithing books but also loading manuals and other cartridge books. If the long, separate index of books (the "Gunsmith's Bookstore") in the Brownell catalog doesn't list any books that you want, then —

A. You already have all those books —
B: You don't know how to read —
C. You hate guns — or
D. You're blind.

Hungry Horse Books; 4605 Highway 93 South; Whitefish, Montana 59937; (406) 862-7997 or 755-3332; catalog lists by category, for example, books on firearms, edged weapons, gunsmithing, handloading, African safaris, hunting, competition shooting; Mike Renner.

Blacktail Mountain Books; 42 First Avenue West; Kalispell, Montana 59901; (406) 257-5573; used and out-of-print books on guns and hunting; where I got my copies of Datig's cartridge books. Jim Handcock.

Rutgers Book Center; 127 Raritan Avenue; Highland Park, New Jersey 08904; (201) 545-4344; fine books on gun collecting, militaria, Western Americana, antiques, sailing, and hunting; Mark Aziz.

Every cartridge enthusiast can find something worth knowing or noting in two books published by ANSI and SAAMI, including the official maximum dimensions for currently manufactured cartridges, the official minimum dimensions for their chambers, and all sorts of good stuff about the procedures and equipment associated with them — including headspace gauges. SAAMI also publishes safety tracts on ammunition, powders, and primers that should be part of every handloader's library. SAAMI/ANSI Z299.4-1992, *Voluntary Industry Performance Standards for Pressure and Velocity of Centerfire Rifle Sporting Ammunition for the Use of Commercial Manufacturers*, and SAAMI/ANSI Z299.3-1993, *Voluntary Industry Performance Standards for Pressure and Velocity of Centerfire Pistol and Revolver Ammunition for the Use of Commercial Manufacturers.* **SAAMI** (Sporting Arms & Ammunition Manufacturers' Institute, Inc); 555 Danbury Road; Wilton, Connecticut 06897.
ANSI (American National Standards Institute); 11 West 42nd Street, 13th Floor; New York, New York 10036; (212) 642-4900.

RCBS published, and presumably still offers, a superbly executed (but limited) set of fully dimensioned cartridge and chamber drawings printed on heavy card stock, in a padded three-ring vinyl binder. For the 120 (or so) rifle and handgun cartridges in this set, these are the drawings most likely to be useful to gunsmiths. *Cartridge and Chamber Drawings.* **RCBS**, Division of Blount, Inc; 605 Oro Dam Boulevard; Oroville, California 95965; (800) 533-5000; (916) 533-5191.

A similar three-ring binder from JGS offers

a more nearly comprehensive set of reamer dimensions for the most popular standard and wildcat cartridges. These drawings, printed on both sides of yellow card-stock pages, are a little harder to read than the RCBS cartridge and chamber drawings. But Jim Cuthbert (JGS) has already added a supplement comprising most if not all the Ackley cartridges and plans to add more from time to time. This binder also includes pages detailing the chambering reamers and related fine goodies JGS makes for the gun trade. **JGS Precision Tool Mfg**; 1141 South Sumner Road; Coos Bay Oregon 97420; (503) 257-4331.

Parker O Ackley, *Handbook for Shooters and Reloaders*, two volumes (1962), hard cover, 567 pages (volume one), 495 pages (volume two), 5-1/2 x 8-1/2 inches. I include these two volumes *not for their load data*, which are too often dangerous, but for their historical value as catalogs of interesting wildcat cartridges and their informative chapters on tests and theories.

The late P O Ackley gathered his load data without caution or discretion, it seems, from the proud originators of the cartridges he catalogued in these books — and in those days before easy access to chronographs and virtually no emphasis on careful attention to signs of high pressure, wildcatters often overloaded their creations. A few of Ackley's observations seem a bit dated now, but they're still worth study. The main thing is to distrust the loads listed — drop back an obviously healthful few grains if you try any load listed in Ackley's books.

Someone keeps these old-timers in print, and any seller of old gun books should have them or know where to get them. I see them on tables at virtually every gun show I go to (mine are originals, so they obviously don't indicate who's reprinted the versions currently available).

George C Nonte, *Cartridge Conversions* and *The Home Guide to Cartridge Conversions* — same book, two titles — still occasionally available from dealers in used and out-of-print books and occasionally reprinted. This was the first-ever treatise on how to modify available cases to serve in chambers reamed for other cartridges, so it's worth perusing for its historical value as well as for its chapter material that doesn't go out of date.

John J Donnelly, *The Handloader's Manual of Cartridge Conversions* — still in print, from Stoeger (who publishes it) and most sellers of gun books. Unfortunately riddled with obvious and insidious errors throughout the cartridge pages, my friend John's book nonetheless includes much worthy material — including dimensions for cartridges not included in my book.

The publisher of the *Handloader* and *Rifle* magazines has compiled three separately bound collections of selected articles, columns, and cartridge drawings from back issues. The first volume of *Wildcat Cartridges* comprises several of Ken Waters' "Wildcat Cartridges" columns published in *Handloader*. Some but not all these columns include cartridge drawings by the late Dave LeGate. The second volume, a huge tome, comprises dozens of old *Handloader* articles by other writers, also illustrated in part with Dave LeGate's cartridge drawings. Both volumes include notes on loads.

But *The Illustrated Reference of Cartridge Dimensions*, from the same publisher, includes no text or loads, just a collection of Dave's lovely cartridge drawings, plus a dozen or more added by someone else, with no credit given to either artist. For no conscionable reason I can think of, the publisher has even taken the extra effort to delete Dave's exquisite and distinctive little personal logotypes from his drawings. I worked with Dave for several years and saw the extra effort he put into his cartridge research. He spent a great deal of his own money on those projects, too, so it's a double shame that neither his name nor his two neat, unobtrusive little "signature" logos appear in this book based almost entirely on his unassisted work.

Unexpurgated LeGate cartridge drawings adorn most of the chapters in Ken Waters' *Pet Loads*, a loose-leaf collection of Ken's *Handloader* articles published under the "Pet Loads" eyebrow. As dedicated fans of Ken's continuing series know well, Ken tests a wider variety of loads for each article than any other gun writer and publishes his results with full commentary and his appraisal of each notably good, excessive, or unacceptable load. **Wolfe Publishing Company**; 6471 Airpark Drive; Prescott, Arizona 86301; (602) 445-7810.

Warner and Bell, editors, *Handloader's Digest*, thirteen editions so far; soft cover. Among the potpourri of articles in these occasional magazines *cum* reference publications, you'll find interesting and informative reading on all aspects of cartridges. You'll want the entire run of them, once one of them has you hooked, but only the current one is available from DBI Books. Look for the the others at gun shows and sellers of old gun books. **DBI Books, Inc**; 4092 Commercial Avenue; Northbrook, Illinois 60062; (708) 272-6310.

From the same publisher, by the late Frank C Barnes *et alii, Cartridges of the World*, seven editions so far. These are primarily collector and reference books, with a few handloads thrown in. Unlike DBI's *Gun Digest* and *Handloader's Digest*, each edition of *Cartridges of the World* essentially obsoletes its predecessors. The first six editions are classics occasionally available at gun shows.

The latest edition, prepared by industry veteran Mike Bussard and a huge panel of unpaid cartridge experts, in the style and format established by Barnes, is available from DBI Books, Inc, and the many retailers of DBI's books. Soft cover, 464 pages (8-1/4 x 10-3/4 inches), with sections comprising short but pithy entries on current American rifle cartridges, obsolete American rifle cartridges, wildcat and proprietary cartridges, pistol and revolver cartridges, British sporting-rifle cartridges, American rimfire cartridges, shotgun shells, and chapters on cartridge identification, primer chemistry, bench-rest cartridges, US military tracer ammunition, and SAAMI. Each cartridge section includes a table of dimensions — limited, unfortunately, to fewer dimensions than most of us look for and apparently compiled from Barnes's and others' measurements of specimen cartridges.

The panel of cartridge experts who took up Barnes's project after his death turned in far more material than the scissors-and-pastepot ladies at DBI Books assembled for the first post-Barnes edition, so let's hope the rest of their material will appear in the eighth edition, once DBI empties its shelves of the seventh edition.

Fred A Datig, *Cartridges for Collectors*, volumes I (1956), II (1958), III (1967), IV (1983), hard cover; 174, 176, 176, and 283 pages (6 x 9 inches). These beautifully illustrated little books exhibit no over-all plan I can discern but list and show in some detail a wide variety of centerfire, rimfire, patent-ignition, and plastic cartridges from all over hither and yon. (Wish I could draw cartridges like Walter Ludwig and E L Scranton, the fellows who illustrated these fine little books for collectors — and would like to choke the idiot who compiled the index *in page-number order*.) Volumes I, II, III published by Borden Publishing Company; 1855 West Main Street; Alhambra, California 91801; Volume IV published by the author; Lucerne, Switzerland.

Bill Fleming, *British Sporting Rifle Cartridges* (1993), hard cover, 311 pages (8-1/2 x 11 inches); "a summary of case types, headstamps, bullets, and charge variations," the subtitle says; copiously illustrated with excellent specimen photographs, original cartridge drawings, patent drawings, and pages from Holland & Holland, Joseph Lang, and Manton catalogs. Many tables in this high-quality volume. **Armory Publications**; P O Box 4206; Oceanside, California 92052. (The same author and publisher also have a thirty-two page booklet, *Prices Paid for British Sporting Rifle Cartridges*.)

Jean Huon, *Military Rifle & Machine Gun Cartridges* (1988), hard cover, 378 pages (6 x 8-1/2 inches), English-language edition of French original, brief notes and some dimensions on cartridges from 4.5 to 18mm, Enfield and Mauser to Kalashnikov; .17 to .60, Remington and Winchester to Martini, with plenty of *et cetera*s, copiously illustrated with drawings and photographs. **Ironside International Publishers, Inc**; address and telephone not listed; Alexandria, Virginia 22313-0055.

P[eter] Labbett, *British Small Arms Ammunition 1864-1938* "(other than .303 inch calibre)" (1993), hard cover, 352 pages (8-1/2 x 11 inches), copiously illustrated with drawings and photographs of cartridges, bullets, headstamps, firearms. **Armory Publications**; P O Box 4206; Oceanside, California 92052.

Also by Labbett, *Military Small Arms Ammunition of the World, 1945-1980*, hard cover (1980), 128 pages (7-1/4 x 9-3/4 inches), abundantly and beautifully illustrated with photo-

graphs and line drawings — specimen and cutaway cartridges, headstamps, cartridge boxes, bullets. Worth special note: geographical register of ammunition producers and users and appendix of non-Western alphabets and numerals (Serbian, Croatian, Korean, Amharic, Cyrillic, Burmese, Thai, Chinese, Arabic, Hebrew). **Presidio Press**; P O Box 3515; San Rafael, California 94902.

Herschel C Logan, *Cartridges* (1959); "a pictorial digest of small arms ammunition," hard cover, 204 pages (7-3/4 x 10-1/2 inches), the history of cartridge development beautifully illustrated with pen-and-ink drawings by the well known woodcut artist Logan. Informative, fascinating, worth having as a work of art as well as a historical reference. Reprinted 19?? by Bonanza Books, New York, occasionally available at gun shows and from used-book dealers.

Hans A Erlmeier & Jakob H Brandt, *Handbuch der Pistolen- und Revolver- Patronen, Band I, Zentralfeuer, Metrische Kaliber* (*Manual of Pistol and Revolver Cartridges, Volume I, Centerfire, Metric Calibers*) and *Band II, Zentralfeuer, Americanische und Britische Kaliber* (*Volume II, Centerfire, American and British Calibers*), hard cover, 271 pages (Volume I — I haven't seen Volume II yet), 7-3/4 x 10-5/8 inches, parallel German and English text, with brief historical notes and a few dimensions on pistol and revolver cartridges, including references to their synonymous designations and for most entries, clear photographs and drawings for easy visual identification. Publisher and source aren't shown — check with gun-book dealers.

George A Hoyem, *History and Development of Small Arms Ammunition*, three volumes (1981; 1982, revised 1990; and 1991); hard cover; 230, 303, and 220 pages (8-1/4 x 11 inches). Three rich volumes filled with excellent photographs and drawings with text on martial long arms, flintlock through rimfire (Volume One); primitive centerfire short and long arms, and martial long arms (Volume Two); and British sporting rifles (Volume Three, continued by Bill Fleming in *British Sporting Rifle Cartridges*, (above). Tables, cartridge boxes, cartridges, firearms, headstamps, loading tools, catalog pages, cartridge boards — everything, it seems, Hoyem could gather to relate and illustrate his subject. **Armory Publications**; P O Box 4206; Oceanside, California 92052.

Edward A Matunas, *Lyman's Guide to Big Game Cartridges & Rifles*, "a complete reference guide to the best cartridges, rifles and equipment for big game hunting" (1993), soft cover, 288 pages (8-1/2 x 11 inches). Focusing mainly on which cartridges are best for big game from "antelope to elephant," Ed's well illustrated book includes a generous sprinkling of his personally tested handloads. **Lyman Products Corporation**; Route 147; Middlefield, Connecticut 06455; (203) 349-3421.

Philippe Mention & Christian Ramio, *Les Cartouches du Systeme Gras* (*Cartridges of the Gras System*), translated by H Bernard Malric (1988), hard cover, 147 pages (8-1/2 x 11 inches), parallel French and English text; many photographs and drawings of cartridges, tools, headstamps, bullets, and precartridge loads. **Armory Publications**; P O Box 4206; Oceanside, California 92052.

Paul B Moore, *The Handbook of Commercial Bullet Casting*, second edition (1993), soft cover, 154 pages (5-1/2 x 8-1/2 inches). As a friend of Moore's writes in the foreword,

"Don't let the title ... fool you, fellows. This is ... *the* handbook for commercial bullet-casters, but the make-'em-for-money people aren't the only ones who need to keep it handy and consult it often. Any ... bullet caster could tear out and throw away its chapters on ... machinery ... its chapters on doing business as a commercial producer of cast bullets, and he would still have a manual on bullet casting that's worth more than it costs.

"Every bullet caster alive needs to note that an awful lot of ancient folklore persists about the metals and means of casting bullets... **this book is *the* word on bullet casting**. If you know anything at all about casting bullets but you didn't learn it from this little book, then you know a lot that just ain't so. And you need to get it straight. This book is how you get it straight."

True. I couldn't have said it better myself — and any one of the chapters I'm going to list is "must" reading for anyone who casts bullets: alloys and metals, casting by hand, moulds and

mould care, essentials for accuracy, alloying and refining, finding metals suppliers, safety and hazards, and sources of equipment, services, and supplies. Moore, according to the foreword, is "the technical expert behind Lawrence Brand shot and Taracorp's Magnum bullet alloy.... also the originator of a technique that for all these years someone else has been getting the credit for: heat-treating cast bullets (which he discusses ... in this handbook)....

"He obviously knows the ins and outs of lead chemistry and the lead-alloy industry... is well known and deeply respected throughout that industry.... what he tells you in this handbook is not flimsy folklore or thin stuff from a hobby caster; it includes some of the meaty secrets of the lead-alloy industry, from one of its top professionals.

"Paul is a metals chemist who specializes in lead-based alloys. He's also a shooter, a handloader, a bullet caster, an experimenter...."

You can get this one from **Magma Engineering Company**, P O Box 161; Queen Creek, Arizona 85242; (602) 987-9008.

Earl Naramore, *Principles and Practice of Loading Ammunition* — published by Stackpole and long out of print, but it's still well worth having a book-finder service search for this definitive textbook on loading ammunition. Naramore's book, never as well known and respected as Sharpe's book (next), is worth infinitely more.

Philip B Sharpe's *The Complete Guide to Handloading,* published in at least two editions (pre- and post-World War Two) reminds me of my shipmate Jack Horton's coffee trip from the sound stage to the cafeteria at the Naval Photographic Center. Jack was a white-hat-and-dungarees photographer's mate, but the good-looking Kentuckian fit the image the navy brass and Hollywood civilians on the sound stage wanted in a certain background role as a navy officer. So they spiffed him up with officer's gold braid and silver collar devices for the movie. Between takes, the brass sent him up to the cafeteria to get coffee for the real officers on the sound stage. Jack had ceased to be conscious of his movie costume, so he was genuinely puzzled when a chief petty officer standing in the cafeteria line, too new on board to know who Jack really was, invited him to the front of the line, then held the door open for Jack to leave with the coffee tray.

Funk & Wagnalls published Sharpe's *Complete Guide* in a fancy, dignified volume that implied a high level of quality and authority. But handloaders of the time considered it analogous to a swabbie in a captain's blues and braid. I'm ambivalent about it, I guess — sold my early edition many years ago, then bought another one years later. It's worth studying, too good to ignore altogether, but not altogether The Word From On High it's supposed to be, so it's not worth a heavy price at a gun show or from a used-book dealer. Get to know it before you decide whether to make it part of your library.

Cartucheria Española, by Angel Molina Lopez and Alfonso Orea Mæstro, 1,308 pages, softbound. Describes (in Spanish and English) and illustrates (beautifully) every loading of every cartridge available in Spain: history, headstamps, every detail. Limited supply. **Forensic Ammunition Service**; ATTN G G Kass; 4512 Nakoma Drive; Okemos, Michigan 48864; [517] 349-9362.

Fred Sinclair and Bill Gravatt, *Precision Reloading & Shooting Handbook*, 9th edition. Soft covers, bound with plastic fingers, 74 pages (8-1/2 x 11 inches), Item Number BK9(CC). Discussions about handloading techniques for precision shooting — setting up to load, preparing cases, developing loads, benchrest equipment and techniques, bore-cleaning techniques, scopes and mounts, parallax, chamber casts, and sources. *No load data.* Sinclair has more good stuff than you ever thought precise handloading could involve. Get their catalog too. **Sinclair International, Inc**; 2330 Wayne Haven Street; Fort Wayne, Indiana 46803; (219) 493-1858.

Handloading Manuals

Except for the Australia-New Zealand manual by Nick Harvey, the German *Wiederladen* (means *handloading*, I think) from the Old Western Scrounger, and the Lapua (*LOP-wah*) and Vihtavuori (*VEE-ta-VOO-ree*) manuals from Finland, all these other loading manuals ought to be available at any well stocked purveyor of goods and supplies for handloaders (HDS, for example). I've added to these thumbnail reviews

an index that lists, cartridge by cartridge, which manuals include load data for each cartridge listed in this index (below).

Presumably, the publishers of these manuals have tested the load data for themselves. But since I have no idea where some other publishers got their load data, I haven't included their manuals in my index of load data. Forty years ago, I learned the folly of using loads published by a famous gun writer.

For my loads in one of his wildcat cartridges with a 150-grain bullet, I dropped back six grains from his load for a 180-grain bullet. My starter loads swelled case heads so badly, I found I could drop the spent primer into the primer pocket, then dump it back into my hand by simply up-ending the fired case.

More recently, editing the writings of another well known gun writer, I found that many of the load data he submitted with his article manuscripts were clearly too hot for a responsible magazine to publish. I simply dropped those loads from the data we published in the magazine — especially after I learned that some of the loads he'd sent me had bulged the chamber in one of his rifles.

Handloaders' penchant for too readily adopting published load data reminds me of something I read thirty years ago, when I was flying light aircraft. An aviation writer noted that many people who (wisely) wouldn't think of getting into a car for a ride with a stranger would abandon all caution at the drop of a hint and eagerly plop their children into the cockpit of a light plane for a ride with a private pilot whose character and skill they knew nothing about.

He suggested, obviously, that one should be as wary of invitations from strange pilots as they'd be of invitations from strange drivers. The pilot who gives you a ride hauls his own hide right along with yours, equally at risk; the gun writer whose loads you adopt too readily most likely won't be in the same state of the US when you shoot his loads in your gun.

The wisest way to look at even the tested load data in these manuals from the powder and bullet companies, then, is to remember that responsibly published load data are *de*scriptive, not *pre*scriptive. They *de*scribe the performance of the listed loads *in the test guns*, under the test conditions; their data do not *pre*scribe loads for your gun (or any other gun) or predict the performance you'll get.

Data on even the most thoroughly tested loads are no more than basic references to give you an idea where to start with your first trial loads — which powder or powders are suitable, which powder is likely to give you your best load, and the range of velocities to expect from safe loads in barrels of comparable lengths.

It's silly, then, to complain that the load someone says gave him 2,900 feet per second gives you only 2,850 feet per second with the same bullet. It could be worse — velocity is one thing, safety another and vastly more serious matter altogether.

One truly ancient manual, recently reprinted (1992) and worth having despite its lack of modern load data, is *The Ideal Hand Book of Useful Information for Shooters*, Number 5, published originally by John Barlow's Ideal Manufacturing Company (which we know today as Lyman) of New Haven, Connecticut. The cover of Barlow's original Ideal handbook included the instruction *destroy all previous lists*, so it's easy to see why so few of these old manuals survive. George Hoyem's high-quality reprint is obviously no more and no less than a faithful reproduction of the original, on good paper. Its pages will remind you how much better we have some things today than our pappies had 'em in The Good Old Days. **Hoyem Publications**; 503 Clark Road; Bellingham, Washington 98225; (206) 676-0864.

Accurate Arms Company, *Loading Guide* Number One (1994), soft cover, 346 pages (8-1/2x11 inches), listing starting and maximum loads, with respective peak pressures in copper units, using Accurate Arms Company's powders and bullets from virtually all sources. **Accurate Arms Company, Inc**; Route 1, Box 167; McEwen, Tennessee 37101; (615) 729-4207.

Barnes Bullets Reloading Manual Number One (1992), hard cover, 356 pages (3-1/2 x 8-1/2 inches), listing starting and maximum loads for rifle and handgun cartridges with Barnes bullets and American powders. Also ballistics tables (mislabeled "trajectory" tables but including ve-

locity and energy figures out to six hundred yards). **Barnes Bullets**; P O Box 215 (318 South 860 East); American Fork, Utah 84003; (800) 574-9200; (801) 756-4222.

Nick Harvey's Practical Reloading Manual, subtitled *Tools, Powders, Components and Techniques for Australia and New Zealand* (1993), soft cover, 234 pages (7-1/4 x 10-1/4 inches), well larded with American influence and spiced with occasional oddities (cartridges, components, and equipment) seen more often in Australia and New Zealand than in the United States, and a few American wildcats not listed in American manuals. Nick tells me he "will be doing an American edition of my book soon." **Nick Harvey**; Reef Street, Hill End; *via* Mudgee, NSW; Australia.

Hodgdon Data Manual, 26th Edition (1993), hard cover, 800 pages (5-1/2 x 8-1/2 inches) listing starting and maximum loads for rifle and handgun cartridges with bullets of unspecified brands and Hercules, Hodgdon, IMR, and Winchester powders. Hodgdon tests loads *in a pressure gun* and lists the chamber pressure of each load in the manual. This manual includes chapters on handgun silhouette loads, shotshell loads, and Pyrodex loads in cartridges and muzzle-loaders (rifles and shotguns).

Hornady Handbook of Cartridge Reloading, Fourth Edition (1991), two volumes, hard cover, 648 pages (volume one) and 476 pages (volume two), 6 x 9 inches.

Volume One: loads for rifle and handgun cartridges, using Hornady bullets and American powders, plus chapters on handloading and accuracy, handloading, safety, pressure signs, special tips and techniques, developing loads.

Volume Two: extensive, easy-to-use ballistics tables for rifle and single-shot-pistol loads, long-range rifle loads, short-range pistol loads, and long-range pistol and silhouette loads; wind-drift tables; uphill- and downhill-shooting tables, useful charts and conversion tables, and an illustrated glossary. **Hornady Manufacturing Company**; P O Box 1848; Grand Island, Nebraska 68802; (308) 382-1390.

Lapua Reloading Manual, 1st Edition (1993), hard cover, 374 pages (6 x 8 inches), listing load data for American, European, and Scandinavian rifle and handgun cartridges using Vihtavuori powders, with chapters on components, basic handloading, handloading for accuracy, technical tips and troubleshooting; plus ballistics tables, a reference section, and an illustrated glossary. **Cartridge Factory Lapua Ltd**; P O Box 5; SF-62101 Lapua; Finland; **Lapua, Finland**; c/o KFS, Inc; P O Box 44405; Atlanta, Georgia 30336-1405; (404) 691-7611.

Lyman Cast Bullet Handbook, Third Edition (1980), soft cover, 416 pages (8-1/2 x 11 inches). Cast-bullet load data, of course; chapters on the histories of cast bullets and Lyman's predecessor Ideal, the metallurgy of molten lead alloys, casting and loading lead-alloy bullets, accuracy tips and techniques, hunting with cast bullets, muzzle-loader bullets, and ballistics tables (trajectory and wind drift). **Lyman Products Corporation**; Route 147; Middlefield, Connecticut 06455; (203) 349-3421.

Lyman Pistol and Revolver Reloading Handbook, Second Edition (1994), soft cover, 288 pages (8-1/2 x 11 inches). Starting and maximum loads (and respective pressures in copper units) with a wide variety of powders and both cast and jacketed bullets. Includes several new cartridges (.40 S&W, 9x18mm Makarov, 9x21-mm IMI, 9x25mm Dillon, .454 Casull Magnum) and several text chapters by handgunner stars Cameron Hopkins, Ed Matunas, Arnt-Magne Myhre, and Hank Williams, Jr (who's not only a better singer than his father but also, it turns out, a crackin' good gun writer who knows his six-guns and how to handle them). **Lyman Products Corporation**; Route 147; Middlefield, Connecticut 06455; (203) 349-3421.

Lyman Reloading Handbook, 47th Edition (1992), soft cover, 480 pages (8-1/2 x 11 inches). Starting and maximum loads with American powders, jacketed bullets, and lead-alloy bullets cast in Lyman moulds, with chapters on handloading, components, cast bullets, handload performance on game and targets, ballistics, and a reference section with specifications of factory ammunition, maximum case lengths and trim lengths, table of shell holders, calculating recoil, conversion tables, and a glossary. **Lyman Products Corporation**; Route 147; Middlefield, Connecticut 06455; (203) 349-3421.

Nosler Reloading Manual Number Three (1989), hard cover, 514 pages (5-1/2 x 8-1/2 inches). Load data for handgun and rifle cartridges using Nosler bullets and American powders. Chapters on shooters' rights under the Second Amendment to the US Constitution, handloading, accuracy, technical tips and troubleshooting, evaluating handgun hunting loads, ballistics tables, and an illustrated glossary. **Nosler Inc**; P O Box 671; Bend, Oregon 97709; (503) 382-3921.

Sierra Rifle Reloading Manual and *Sierra Handgun Reloading Manual*, Third Edition (1989), loose-leaf binder covers, 856 pages (rifle) and 704 pages (handgun), 5-1/2 x 8-1/2 inches, listing a variety of loads with Sierra bullets, usually with American powders, occasionally with Norma powder. Both volumes include chapters on rifle and handgun competition, Sierra hunting bullets, handgun hunting, choosing the correct pistol bullet, chronographs, Sierra's exterior-ballistics program for personal computers, handloading, exterior ballistics (with tables), and a reference section covering barrel care and cleaning, a chart of shell holders, tables of barrel twists, common conversion factors, and tables of decimal-fraction equivalents. **Sierra Bullets**; 1400 West Henry Street; Sedalia, Missouri 65301; (816) 827-6300.

Speer Reloading Manual Number 12 (just out — late 1994), laminated hard cover, 720 pages (5-1/4 x 9 inches) listing loads with Speer bullets and American and imported powders. "Number Twelve" is an all-new manual, with totally rewritten text and all-new tested loads, by a new staff of CCI-Speer load testers and editors. (For years 'n' years, the recently retired Dave Andrews put together the familiar hard-cover Speer manuals.)

New in this edition are loads for sixteen more rifle and handgun cartridges, and chapters on handloading, modern cartridges and components, ballistics, safety in handloading, the basics and fine-tuning of loads, automated loading, loading handgun shotshells, plastic-bullet ammunition, and a reference section with conversion tables, ballistics tables, and velocity variations with temperature changes.

The load-data pages now include not only more powders (as many as fifteen with a given bullet) from virtually all sources, domestic and foreign, but also more information on the cartridge — the RCBS shell-holder number, the cases used, their trim length, the primers used, the maximum case and cartridge lengths, the over-all lengths of tested loads, and the part number for the Speer bullet. Also noted: the firearm used in testing the loads, its barrel length, and its rifling twist. The new data tables identify compressed loads.

Of course, the new Speer manual includes loads for the fifty-four new bullets added to the Speer stables since the last Speer manual, vintage 1987 — including those introduced as late as this year.

I especially like the cautions listed for using inertia bullet-pullers properly. This type of bullet-puller has been known to set off primers — which by design and manufacture are supposed to behave quietly when you push them but react violently to impact. **Blount, Inc**, CCI-Speer Operations; P O Box 856; Lewiston, Idaho 83501; (800) 627-3640; (208) 746-2351.

SPG Lubricants BP Cartridge Reloading Primer (1992), by Mike Venturino and Steve Garbe, soft covers bound with wire fingers, 116 pages (6 x 9 inches), covering the basics of handloading black-powder cartridges, including match cartridges; load data for black-powder cartridges; ballistics charts; and loading equipment and accessories. **Cal·Graf**; P O Box 306; Big Timber, Montana 59011, or **SPG Lubricant**; P O Box 761; Livingston, Montana 59047.

Vihtavuori Reloading Manual, First Edition (1994), hard covers, 288 pages (6 x 8-1/4 inches). Chapters on powders and primers; other cartridge components and properties; exterior ballistics; handloading; load data (in both British-American and metric units of measure) for 63 rifle and 21 handgun cartridges, using Vihtavuori powders and European, Scandinavian, and American bullets; ballistics measurements; converting units of measure; and an illustrated glossary. **Kaltron-Pettibone**; 1241 Ellis Street; Bensenville, Illinois 60106; (800) 683-0464

Wiederladen, by Dynamit Nobel (1992), hard cover, 600+ pages (5-1/2 x 8-1/2 inches), *entirely in German*. Loads for American and Eu-

ropean cartridges, using Rottweil powders with RWS and American bullets, plus chapters I can't read and thus can't review for you. **The Old Western Scrounger, Inc**; 12924 Highway A-12; Montague, California 96064; (916) 459-5445; or **Dynamit Nobel RWS Inc**; 81 Ruckman Road; Closter, New Jersey 07624; (201) 767-1995.

Each of these handloading manuals lists handload data for its own variety of cartridges. I don't think any two of the handbooks I've just reviewed cover the same list of cartridges. Several cartridges show up in only one manual or another. Also, if any of these books defines the "same as" powders, I missed it. So here are two lists to make these manuals a tad more helpful:

¤ nine powders that are really only three powders packaged behind nine labels from three powder companies
¤ which manual or manuals have loading data for each cartridge in this list

The latter list also notes the pistol and revolver cartridges included in Magma Engineering Company's Load Master computer software (see the subheading "Computer Software," below).

"Same-as" Powders

Hercules **Reloder 15** is the same as **Norma N203** and **Rottweil R902.**

Hercules **Reloder 19** is the same as **Norma N204** and **Rottweil R904.**

Hercules **Reloder 22** is the same as **Norma MRP** and **Rottweil R905.**

Norma gets their sporting powders from Nobel Industries (like Bofors, Nobel Industries is a division of Nobel Chemicals, Sweden), and Hercules imports these three to wear these respective Reloder labels. (So now you can smile and nod knowingly when you read about "how close" one of these nine powders is to another — or maybe even how much better one is than the other.) According to Hercules,

"Reloder 15, Reloder 19, and Reloder 22 are improved versions of the powders previously sold by Norma as N203, N204, and MRP. Norma introduced N203 as a replacement for N202 as it is better suited to the American market in medium size cases being about 3% slower burning than N202. Rottweil R902 is identical to Norma N202. Rottweil R904 and Norma N204 are identical as is Rottweil R905 and Norma N205.

"The improved versions Hercules is importing have better deterrents for burn rate control and better moisture resistance. Using the old rule of thumb of reducing the powder charge by 10% and then carefully working back up when changing component lots should be adequate when substituting Reloder powders for either the Norma or Rottweil equivalents."

So whenever one of these manuals lists one these powders that you can't find under that designation, look for it under one of its "same-as" aliases. A load listed for Rottweil R905 in a handbook, for example, wouldn't interest me much if I didn't know I could get it as Hercules Reloder 22 — and exactly the opposite would be true for a German handloader looking up loads in an American manual that listed loads for Reloder 22.

Which manual has loads for ... ?

.17 Ackley Hornet Harvey
.17 Ackley Bee Harvey, Hodgdon
.17 Bumblebee Hodgdon
.17 CCM Accurate
.17-.222 Harvey, Hodgdon
.17-.223 Hodgdon
.17 Mach IV Accurate, Harvey, Hodgdon, Hornady
.17 Remington Accurate, Harvey, Hodgdon, Hornady, Lyman 47, Vihtavuori, *Wiederladen*
.218 Bee Accurate, Harvey, Hodgdon, Hornady, Lyman CBH3, Lyman 47, Nosler, Sierra, Speer
.219 Wasp Hodgdon, Hornady, Sierra
.219 Zipper Accurate, Harvey, Hornady, Sierra
.22 BR Remington Accurate, Hodgdon, Hornady, Nosler
.22 CCM Accurate
.22 CHeetah Mk II Hodgdon
.22 Hi-Power Harvey, Hornady
.22 Hornet Accurate, Harvey, Hodgdon, Hornady, Lyman 47, Lyman CBH3, Lyman PRH2, Nosler, Sierra, Speer, Vihtavuori, *Wiederladen*
.22 K-Hornet Harvey, Sierra
.22 PPC Accurate, Harvey, Hodgdon,

Hornady, Lyman 47, Nosler, Sierra, Speer, Vihtavuori
.22 Remington Jet Harvey, Hodgdon, Hornady, Lyman CBH3, Sierra
.22 Savage Lyman CBH3
.22-.250 Remington Accurate, Harvey, Hodgdon, Hornady, Lapua, Lyman CBH3, Lyman 47, Nosler, Sierra, Speer, Vihtavuori, *Wiederladen*
.220 Jaybird Hodgdon
.220 Russian Vihtavuori
.220 Swift Accurate, Harvey, Hodgdon, Hornady, Lapua, Lyman CBH3, Lyman 47, Nosler, Sierra, Speer, Vihtavuori, *Wiederladen*
.221 Remington Fireball Accurate, Harvey, Hodgdon, Hornady, Lyman CBH3, Lyman 47, Lyman PRH2, Nosler, Sierra, *Wiederladen*
.222 Remington Accurate, Harvey, Hodgdon, Hornady, Lapua, Lyman CBH3, Lyman 47, Lyman PRH2, Nosler, Sierra, Speer, Vihtavuori, *Wiederladen*
.222 Remington Magnum Accurate, Harvey, Hodgdon, Hornady, Lapua, Lyman CBH3, Lyman 47, Nosler, Sierra, Speer, Vihtavuori, *Wiederladen*
.222 Rimmed Harvey
.223 Remington Accurate, Harvey, Hodgdon, Hornady, Lapua, Lyman CBH3, Lyman 47, Lyman PRH2, Nosler, Sierra, Speer, Vihtavuori, *Wiederladen*
.224 Weatherby Magnum Accurate, Harvey, Hodgdon, Hornady, Lyman CBH3, Lyman 47, Sierra, *Wiederladen*
.225 Winchester Accurate, Harvey, Hodgdon, Hornady, Lyman CBH3, Lyman 47, Nosler, Sierra, Speer
.240 Weatherby Magnum Accurate, Barnes, Harvey, Hodgdon, Hornady, Lyman 47, Nosler, Sierra, Speer
.243 Winchester Accurate, Barnes, Harvey, Hodgdon, Hornady, Lapua, Lyman CBH3, Lyman 47, Nosler, Sierra, Speer, Vihtavuori, *Wiederladen*
.244 Remington (see 6mm Remington)
.25 Automatic Accurate, Harvey, Hodgdon, Hornady, Lapua, Lyman CBH3, Lyman 47, Lyman PRH2, Magma Load Master (software), Sierra, Vihtavuori
.25 IHMSA Hodgdon
.25 Remington Harvey
.25 Souper Harvey
.25-06 Remington Accurate, Barnes, Harvey, Hodgdon, Hornady, Lyman CBH3, Lyman 47, Nosler, Sierra, Speer, Vihtavuori, *Wiederladen*
.25-20 Winchester Accurate, Harvey, Hodgdon, Hornady, Lyman CBH3, Lyman 47, Speer, Vihtavuori
.25-.284 Harvey, Hodgdon
.25-.308 Harvey
.25-35 Winchester Accurate, Harvey, Hodgdon, Hornady, Vihtavuori
.250 Savage Accurate, Barnes, Harvey, Hodgdon, Hornady, Lyman CBH3, Lyman 47, Nosler, Sierra, Speer
.256 Winchester Magnum Accurate, Harvey, Hodgdon, Hornady, Lyman CBH3, Sierra
.257 Kimber Hodgdon
.257 Roberts Accurate, Barnes, Harvey, Hodgdon, Hornady, Lyman CBH3, Lyman 47, Nosler, Sierra, Speer
.257 Roberts Improved Accurate, Harvey, Hornady, Nosler, Sierra
.257 Weatherby Magnum Accurate, Barnes, Harvey, Hodgdon, Hornady, Lyman CBH3, Lyman 47, Nosler, Sierra, Speer
.264 Winchester Magnum Accurate, Barnes, Harvey, Hodgdon, Hornady, Lyman CBH3, Lyman 47, Nosler, Sierra, Speer, Vihtavuori
.265 RCBS Harvey
.270 IHMSA Hodgdon
.270 Ren Accurate, Hodgdon, Hornady, Sierra
.270 Weatherby Magnum Accurate, Harvey, Hodgdon, Hornady, Lyman CBH3, Lyman 47, Nosler, Sierra, Speer, *Wiederladen*
.270 Winchester Accurate, Barnes, Harvey, Hodgdon, Hornady, Lyman CBH3, Lyman 47, Nosler, Sierra, Speer, Vihtavuori, *Wiederladen*
.280 Remington Accurate, Barnes, Harvey, Hodgdon, Hornady, Lyman CBH3, Lyman 47, Nosler, Sierra, Speer, *Wiederladen*
.284 Winchester Accurate, Barnes, Harvey, Hodgdon, Hornady, Lyman CBH3, Lyman 47, Sierra, Speer
.30 Carbine Accurate, Harvey, Hodgdon, Hornady, Lyman CBH3, Lyman 47, Lyman PRH2, Sierra, Speer, Vihtavuori, *Wiederladen*
.30 Herrett Accurate, Hodgdon, Hornady, Sierra

.30 IHMSA Hodgdon
.30 Luger Accurate, Harvey, Hodgdon, Lapua, Lyman CBH3, Lyman 47, Lyman PRH2, Vihtavuori
.30 Mauser Accurate, Lyman CBH3, Lyman PRH2
.30 Remington Lyman CBH3
.30 Rimmed Blaser *Wiederladen*
.30-06 Ackley Improved Harvey
.30-06 Springfield Accurate, Barnes, Harvey, Hodgdon, Hornady, Lapua, Lyman CBH3, Lyman 47, Nosler, Sierra, Speer, Vihtavuori, *Wiederladen*
.30-.284 Hodgdon
.30-30 Winchester Accurate, Barnes, Harvey, Hodgdon, Hornady, Lapua, Lyman 47, Lyman CBH3, Lyman PRH2, Nosler, Sierra, Speer, Vihtavuori, *Wiederladen*
.30-.338 Accurate, Sierra
.30-.378 Weatherby Magnum Accurate
.30-40 Krag Accurate, Hodgdon, Lyman CBH3, Lyman 47, Nosler, Sierra, Speer
.300 H&H Magnum Accurate, Barnes, Harvey, Hodgdon, Hornady, Lapua, Lyman CBH3, Lyman 47, Nosler, Sierra, Speer, Vihtavuori
.300 Savage Accurate, Barnes, Hodgdon, Hornady, Lyman CBH3, Lyman 47, Nosler, Sierra, Speer
.300 Weatherby Magnum Accurate, Barnes, Harvey, Hodgdon, Hornady, Lapua, Lyman CBH3, Lyman 47, Nosler, Sierra, Speer, Vihtavuori, *Wiederladen*
.300 Winchester Magnum Accurate, Barnes, Harvey, Hodgdon, Hornady, Lapua, Lyman CBH3, Lyman 47, Nosler, Sierra, Speer, Vihtavuori, *Wiederladen*
.303 British Accurate, Harvey, Hodgdon, Hornady, Lyman CBH3, Lyman 47, Sierra, Speer, Vihtavuori, *Wiederladen*
.303 Savage Lyman CBH3
.303-.25 (Australia) Harvey
.307 Winchester Accurate, Harvey, Hodgdon, Hornady, Speer, *Wiederladen*
.308 Norma Magnum Accurate, Harvey, Hodgdon, Hornady, Lapua, Lyman CBH3, Lyman 47, Nosler, Sierra, Speer, Vihtavuori
.308 Winchester Accurate, Barnes, Harvey, Hodgdon, Hornady, Lapua, Lyman CBH3, Lyman 47, Nosler, Sierra, Speer, Vihtavuori, *Wiederladen*
.309 JDJ Accurate
.310 Cadet Harvey
.32 Automatic Accurate, Harvey, Hodgdon, Hornady, Lapua, Lyman CBH3, Lyman 47, Lyman PRH2, Magma Load Master (software), Sierra, Vihtavuori
.32 H&R Magnum Accurate, Harvey, Hodgdon, Hornady, Lyman 47, Lyman PRH2, Sierra
.32 Miller Short Accurate
.32 Remington Lyman CBH3
.32 Smith & Wesson Harvey, Hodgdon, Lyman CBH3, Lyman 47, Lyman PRH2, *Wiederladen*
.32 Smith & Wesson Long Accurate, Harvey, Hodgdon, Hornady, Lapua, Lyman 47, Lyman PRH2, Vihtavuori, *Wiederladen*
.32 Winchester Special Harvey, Hodgdon, Lyman CBH3, Lyman 47, Speer
.32-20 Winchester Accurate, Harvey, Hodgdon, Hornady, Lyman CBH3, Lyman 47, Lyman PRH2, Sierra, Speer
.32-40 Winchester Accurate, Harvey, Hodgdon, Lyman CBH3, SPG
.33 Winchester Hornady
.338 IHMSA Hodgdon
.338 Lapua Magnum Lapua, Vihtavuori
.338 Winchester Magnum Accurate, Barnes, Harvey, Hodgdon, Hornady, Lapua, Lyman CBH3, Lyman 47, Nosler, Sierra, Speer, Vihtavuori, *Wiederladen*
.338-06 Accurate, Harvey, Hodgdon, Nosler, Sierra, Speer
.338-06 Improved Harvey
.338-.378 KT Magnum Hodgdon
.340 Weatherby Magnum Accurate, Barnes, Harvey, Hodgdon, Hornady, Lyman CBH3, Lyman 47, Nosler, Sierra, Speer
.348 Winchester Accurate, Barnes, Harvey, Hodgdon, Hornady, Lyman CBH3, Lyman 47
.35 IHMSA Hodgdon
.35 Remington Accurate, Barnes, Harvey, Hodgdon, Hornady, Lyman CBH3, Lyman 47, Lyman PRH2, Sierra, Speer
.35 Whelen Accurate, Barnes, Harvey, Hodgdon, Hornady, Lyman 47, Nosler, Sierra, Speer

.350 Remington Magnum Accurate, Barnes, Harvey, Hodgdon, Hornady, Lyman CBH3, Lyman 47, Nosler, Sierra, Speer
.351 Winchester Self-Loading Rifle Lyman CBH3
.356 Winchester Accurate, Harvey, Hodgdon, Speer
.357 Herrett Accurate, Hodgdon, Hornady, Sierra
.357 Magnum Accurate, Harvey, Hodgdon, Hornady, Lapua, Lyman CBH3, Lyman 47, Lyman PRH2, Magma Load Master (software), Nosler, Sierra, Speer, Vihtavuori, *Wiederladen*
.357 Maximum Accurate, Harvey, Hodgdon, Hornady, Lapua, Lyman 47, Lyman PRH2, Nosler, Sierra, Vihtavuori
.357-.44 Bain & Davis Accurate, Hodgdon, Hornady
.358 Norma Magnum Accurate, Barnes, Harvey, Hodgdon, Hornady, Lyman CBH3, Lyman 47, Nosler, Speer, Vihtavuori
.358 STA Barnes, Hodgdon
.358 Winchester Accurate, Barnes, Harvey, Hodgdon, Hornady, Lyman CBH3, Lyman 47, Nosler, Sierra, Speer
.375 H&H Magnum Accurate, Barnes, Harvey, Hodgdon, Hornady, Lyman CBH3, Lyman 47, Nosler, Sierra, Speer, Vihtavuori, *Wiederladen*
.375 JDJ Accurate, Hodgdon, Hornady
.375 Super Magnum Accurate, Harvey, Hodgdon, Hornady, Sierra
.375 USA Magnum Hodgdon
.375 Weatherby Magnum Barnes, Hodgdon
.375 Winchester Accurate, Barnes, Harvey, Hodgdon, Hornady, Lyman CBH3, Lyman 47, Sierra, Speer
.378 Weatherby Magnum Accurate, Barnes, Harvey, Hornady, Lyman CBH3, Lyman 47, Nosler, Sierra, *Wiederladen*
.38 Automatic Accurate, Hornady
.38 Smith & Wesson Accurate, Harvey, Hodgdon, Lapua, Lyman CBH3, Lyman 47, Lyman PRH2, *Wiederladen*
.38 Smith & Wesson Long Vihtavuori
.38 Special Accurate, Harvey, Hodgdon, Hornady, Lapua, Lyman CBH3, Lyman 47, Lyman PRH2, Magma Load Master (software), Nosler, Sierra, Vihtavuori, *Wiederladen*
.38 Super Automatic Accurate, Harvey, Hodgdon, Hornady, Lyman CBH3, Lyman 47, Lyman PRH2, Magma Load Master (software), Sierra, Vihtavuori, *Wiederladen*
.38-40 Winchester Accurate, Harvey, Hornady, Lyman CBH3, Lyman 47, Lyman PRH2
.38-55 Winchester Accurate, Barnes, Harvey, Hodgdon, Hornady, Lyman CBH3, Lyman 47, SPG
.38-56 Winchester SPG
.380 Automatic Accurate, Harvey, Hodgdon, Hornady, Lapua, Lyman CBH3, Lyman 47, Lyman PRH2, Magma Load Master (software), Nosler, Sierra, Vihtavuori
.40 Smith & Wesson Accurate, Harvey, Hodgdon, Hornady, Lyman 47, Lyman PRH2, Magma Load Master (software), Vihtavuori, *Wiederladen*
.40-50 Bottleneck SPG
.40-50 Straight SPG
.40-60 Maynard SPG
.40-60 Winchester SPG
.40-65 Winchester Accurate
.40-70 Government SPG
.40-70 Sharps Bottleneck SPG
.40-70 Sharps Straight SPG
.40-90 Sharps Bottleneck SPG
.40-90 Sharps Straight SPG
.401 Winchester Self-Loading Lyman CBH3
.404 Jeffery Harvey, *Wiederladen*
.41 Action Express Accurate, Hodgdon, Hornady, Lyman PRH2, Sierra
.41 Magnum Accurate, Harvey, Hodgdon, Hornady, Lyman CBH3, Lyman 47, Lyman PRH2, Magma Load Master (software), Nosler, Sierra, *Wiederladen*
.411 KDF Accurate
.416 Chatfield-Taylor Accurate, Harvey
.416 Remington Magnum Accurate, Barnes, Harvey, Hodgdon, Hornady, Lyman 47, Speer
.416 Rigby Accurate, Barnes, Harvey, Hodgdon, Hornady, Lyman 47
.416 Weatherby Magnum Accurate, Barnes, Harvey, Hodgdon, Hornady, Lyman 47
.44 Auto Magnum Harvey, Hodgdon, Hornady, Sierra

.44 Magnum Accurate, Barnes, Harvey, Hodgdon, Hornady, Lapua, Lyman CBH3, Lyman 47, Lyman PRH2, Magma Load Master (software), Nosler, Sierra, Speer, Vihtavuori
.44 Special Accurate, Harvey, Hodgdon, Hornady, Lyman CBH3, Lyman 47, Lyman PRH2, Magma Load Master (software), Nosler, Sierra, Vihtavuori
.44-40 Winchester Accurate, Harvey, Hodgdon, Hornady, Lyman CBH3, Lyman 47, Lyman PRH2, Magma Load Master (software), *Wiederladen*
.44-77 SPG
.44-90 SPG
.444 Marlin Accurate, Barnes, Harvey, Hodgdon, Hornady, Lyman CBH3, Lyman 47, Sierra, Speer, Vihtavuori, *Wiederladen*
.445 Super Magnum Accurate, Barnes, Hodgdon, Hornady, Lyman PRH2, Sierra
.45 Automatic Accurate, Harvey, Hodgdon, Hornady, Lyman CBH3, Lyman 47, Lyman PRH2, Magma Load Master (software), Nosler, Sierra, Vihtavuori, *Wiederladen*
.45 Automatic Rimmed Accurate, Harvey, Hornady, Lyman CBH3, Lyman 47, Lyman PRH2, Sierra, *Wiederladen*
.45 Colt Accurate, Harvey, Hodgdon, Hornady, Lyman CBH3, Lyman 47, Lyman PRH2, Magma Load Master (software), Nosler, Sierra, Vihtavuori, *Wiederladen*
.45 Winchester Magnum Accurate, Barnes, Harvey, Hodgdon, Hornady, Lyman 47, Lyman PRH2, Nosler, Sierra, Vihtavuori, *Wiederladen*
.45-70 Government Accurate, Barnes, Harvey, Hodgdon, Hornady, Lyman CBH3, Lyman 47, Lyman PRH2, Sierra, Speer, SPG, Vihtavuori, *Wiederladen*
.45-90 (2.4-Inch) SPG
.45-100 (2.6-Inch) SPG
.45-110 (2-7/8-Inch) SPG
.45-120 Sharps SPG
.454 Casull Magnum Accurate, Barnes, Hodgdon, Hornady, Lyman PRH2
.455 Webley Harvey
.458 Winchester Magnum Accurate, Barnes, Harvey, Hodgdon, Hornady, Lyman CBH3, Lyman 47, Speer, Vihtavuori, *Wiederladen*
.458 Lott Barnes
.460 Weatherby Magnum Accurate, Barnes, Harvey, Hodgdon, Hornady, Lyman CBH3, Lyman 47, *Wiederladen*
.470 Capstick Harvey
.470 Nitro Express Harvey, Hodgdon
.475 Number 2 Nitro Express Harvey
.475 OKH (see .470 Capstick)
.50 Action Express Accurate, Lyman PRH2
.50 Browning Accurate, Barnes, Hodgdon, Vihtavuori
.50-70 Government Accurate, Lyman CBH3, Lyman 47, SPG
.50-90 Sharps Accurate, Lyman CBH3, SPG
.50-140 Sharps Accurate, Lyman CBH3, SPG
5.6x35mm Rimmed Vierling Vihtavuori, *Wiederladen*
5.6x50mm Magnum Harvey, Hornady, Lapua, Vihtavuori, *Wiederladen*
5.6x50mm Magnum Rimmed Lapua, Vihtavuori, *Wiederladen*
5.6x52mm Rimmed (see .22 Hi-Power) Vihtavuori, *Wiederladen*
5.6x57mm RWS Harvey, Hornady, Lapua, Vihtavuori, *Wiederladen*
5.6x57mm Rimmed *Wiederladen*
5.6x61mm SE vom Hofe *Wiederladen*
5.6x61mm SE Rimmed vom Hofe *Wiederladen*
6mm BR Remington Accurate, Hodgdon, Hornady, Nosler, Sierra
6mm International Harvey, Sierra
6mm PPC Accurate, Harvey, Hodgdon, Hornady, Lyman 47, Nosler, Sierra, Speer, Vihtavuori, *Wiederladen*
6mm Remington (.244 Remington) Accurate, Barnes, Harvey, Hodgdon, Hornady, Lyman CBH3, Lyman 47, Nosler, Speer, Vihtavuori, *Wiederladen*
6mm T/CU Accurate, Hornady, Sierra
6mm-.222 Hodgdon
6mm-.222 Magnum (6x47mm) Hodgdon
6mm-.223 (6x45mm) Hodgdon
6mm-.284 Harvey, Hodgdon, Hornady
6x47mm Harvey, Hornady, Sierra
6x62mm Frères *Wiederladen*
6.3x53mm Rimmed Vihtavuori
6.35mm *Wiederladen*
6.5mm Carcano Hodgdon, Hornady

6.5mm IHMSA Hodgdon
6.5mm JDJ Accurate, Hodgdon
6.5mm Remington Magnum Accurate, Barnes, Harvey, Hodgdon, Hornady, Lyman CBH3, Lyman 47, Sierra
6.5mm T/CU Accurate, Hodgdon, Hornady, Sierra
6.5-06 Accurate, Harvey, Nosler
6.5-.257 Hodgdon
6.5-.300 Weatherby Magnum Sierra
6.5x50mm Japanese Accurate, Harvey, Hodgdon, Hornady, Lyman CBH3, Sierra
6.5x52mm Mannlicher Carcano Lyman CBH3, Sierra, *Wiederladen*
6.5x52mm Mannlicher Schoenauer Harvey, Hornady
6.5x52mm Rimmed *Wiederladen*
6.5x54mm Mannlicher Schoenauer Lyman CBH3, Sierra, *Wiederladen*
6.5x55mm Swedish Mauser Accurate, Barnes, Harvey, Hodgdon, Hornady, Lapua, Lyman CBH3, Lyman 47, Nosler, Sierra, Speer, Vihtavuori, *Wiederladen*
6.5x57mm Hornady, Lapua, Vihtavuori, *Wiederladen*
6.5x57mm Rimmed Lapua, Vihtavuori, *Wiederladen*
6.5x58mm Rimmed *Wiederladen*
6.5x65mm RWS *Wiederladen*
6.5x65mm Rimmed RWS *Wiederladen*
6.5x68mm Rimmed *Wiederladen*
6.5x68mm RWS Harvey, Lapua, Vihtavuori, *Wiederladen*
6.5x68mm Schuler Hodgdon
6.5x70mm Rimmed *Wiederladen*
7mm BR Remington Accurate, Harvey, Hodgdon, Hornady, Lyman 47, Lyman PRH2, Nosler, Sierra, Vihtavuori
7mm Express Remington (see .280 Remington)
7mm IHMSA Accurate, Hodgdon, Hornady
7mm International Rimmed Hornady, Sierra
7mm Merrill Accurate
7mm Remington Magnum Accurate, Barnes, Harvey, Hodgdon, Hornady, Lapua, Lyman CBH3, Lyman 47, Nosler, Sierra, Speer, Vihtavuori, *Wiederladen*
7mm STE Hodgdon
7mm STW Accurate, Barnes, Harvey, Hodgdon
7mm T/CU Accurate, Hodgdon, Lyman 47, Lyman PRH2, Nosler, Sierra, Vihtavuori
7mm Weatherby Magnum Accurate, Barnes, Harvey, Hodgdon, Hornady, Lyman CBH3, Lyman 47, Nosler, Sierra, Speer
7mm-06 (see .280 Remington)
7mm-08 Remington Accurate, Barnes, Harvey, Hodgdon, Hornady, Lapua, Lyman 47, Nosler, Sierra, Speer, Vihtavuori, *Wiederladen*
7-30 Waters Accurate, Barnes, Harvey, Hodgdon, Hornady, Lyman 47, Lyman PRH2, Nosler, Sierra, Speer
7mm-.300 Weatherby Magnum Sierra
7x33mm Sako Vihtavuori
7x45mm Ingram Hornady
7x54mm Vihtavuori
7x57mm Mauser Accurate, Barnes, Harvey, Hodgdon, Hornady, Lapua, Lyman CBH3, Lyman 47, Nosler, Sierra, Speer, Vihtavuori, *Wiederladen*
7x57mm Rimmed Lapua, Vihtavuori, *Wiederladen*
7x61mm Sharpe & Hart Harvey, Hornady, Lyman CBH3, Sierra
7x64mm Brenneke Harvey, Lapua, Vihtavuori, *Wiederladen*
7x65mm Rimmed Hornady, *Wiederladen*
7x66mm SE vom Hofe *Wiederladen*
7x72mm Rimmed *Wiederladen*
7x75mm SE vom Hofe *Wiederladen*
7.35mm Carcano Harvey, Lyman CBH3
7.5mm Swiss Ordnance *Wiederladen*
7.5x55mm Schmidt Rubin Hodgdon, Hornady, Sierra, *Wiederladen*
7.62mm Tokarev Lyman PRH2
7.62x39mm Russian Accurate, Harvey, Hodgdon, Hornady, Lapua, Lyman 47, Sierra, Speer, Vihtavuori, *Wiederladen*
7.62x53mm Rimmed Lapua, Vihtavuori
7.62x54mm Russian Accurate, Lyman CBH3, Lyman 47, Sierra, *Wiederladen*
7.63mm Mauser *Wiederladen*
7.65 Argentine Mauser Lyman CBH3
7.65mm Belgian Mauser Hornady
7.65mm Browning (see .32 Automatic) *Wiederladen*
7.65mm Parabellum (see .30 Luger)

Wiederladen
7.65x53mm Mauser Accurate, Hodgdon, Lyman 47, Sierra, *Wiederladen*
7.7x58mm Japanese Accurate, Harvey, Hodgdon, Hornady, Lyman CBH3, Sierra
8mm IHMSA Hodgdon
8mm Remington Magnum Accurate, Barnes, Harvey, Hodgdon, Hornady, Lyman CBH3, Lyman 47, Nosler, Sierra, Speer, *Wiederladen*
8mm-06 Accurate, Harvey, Hornady, Sierra, Speer
8x56mm MS *Wiederladen*
8x57mm Mauser Accurate, Barnes, Harvey, Hodgdon, Hornady, Lapua, Lyman CBH3, Lyman 47, Nosler, Sierra, Speer, Vihtavuori, *Wiederladen*
8x57mm Rimmed 360 *Wiederladen*
8x58mm Rimmed *Wiederladen*
8x60mm *Wiederladen*
8x60mm Rimmed *Wiederladen*
8x64mm *Wiederladen*
8x65mm Rimmed *Wiederladen*
8x68mm S Harvey, Hornady, Vihtavuori, *Wiederladen*
8x72mm Rimmed *Wiederladen*
8x75mm Rimmed *Wiederladen*
8.15x46mm Rimmed *Wiederladen*
8.2x53mm Rimmed Lapua, Vihtavuori
8.5x63mm *Wiederladen*
8.5x63mm Rimmed *Wiederladen*
9mm Kurz (see .380 Automatic) *Wiederladen*
9mm Luger (9mm Parabellum) Accurate, Harvey, Hodgdon, Hornady, Lapua, Lyman CBH3, Lyman 47, Lyman PRH2, Magma Load Master (software), Nosler, Sierra, Vihtavuori, *Wiederladen*
9mm Makarov Accurate, Lyman PRH2
9mm Steyr *Wiederladen*
9x18mm Ultra *Wiederladen*
9x21mm Lyman PRH2, *Wiederladen*
9x25mm Lyman PRH2
9x57mm *Wiederladen*
9x57mm Rimmed *Wiederladen*
9.3x53mm Rimmed Vihtavuori
9.3x57mm Vihtavuori, *Wiederladen*
9.3x62mm Accurate, Barnes, Harvey, Lapua, Speer, Vihtavuori, *Wiederladen*
9.3x64mm Brenneke Harvey, Lapua, Vihtavuori, *Wiederladen*
9.3x72mm Rimmed *Wiederladen*
9.3x74mm Rimmed Accurate, Barnes, Lapua, Speer, Vihtavuori, *Wiederladen*
10mm Automatic Accurate, Harvey, Hodgdon, Hornady, Lyman 47, Lyman PRH2, Magma Load Master (software), Nosler, Sierra, Vihtavuori, *Wiederladen*
10mm Magnum Accurate
10.3x60mm Rimmed *Wiederladen*
10.75x68mm *Wiederladen*

Handloading Benches

Booklet, *Set yourself up to reload!*, plans for a sturdy, well designed handloading bench with ample storage space (the loading bench in photos on pages 66 and 68 of *Speer Reloading Manual Number 12*) — **National Reloading Manufacturers' Association**; One Centerpointe Drive, Suite 300; Lake Oswego, Oregon 97035; (503) 639-9190. The NRMA also distributes the SAAMI safety tracts on sporting ammunition, smokeless powder, and primers.

Arrow Star workbenches — steel legs and braces, with tops of butcher-block maple laminates, lumber-and-chipboard laminates, plastic laminates, and steel and hardboard — add-on shelves and drawers above and beneath — also mating or matching workstools, chairs, cabinets, pedestals, bins, lockers, shop floormats, many other goodies for industrial shops, adaptable to handloader's bench operations. **Arrow Star** catalog (800) 645-2982; order (800) 645-2833; four regional warehouses:

¤ 3-1 Park Plaza, Dept CC; **Glen Head, New York 11545**
¤ 2045 South Fordyce Avenue, Dept CC; **Carson, California 90810**
¤ 6087 Buford Highway, Dept CC; **Norcross, Georgia 30071**
¤ 949 Larch Avenue, Dept CC; **Elmhurst, Illinois 60126**

The Workbench Book, Scott Landis, "A craftsman's guide from the publishers of *Fine Woodworking*." An art gallery of fine workbenches — for woodworkers, yes, but chockful of ideas, details, and techniques for anyone who wants to build or have custom-built a fine, lifetime loading bench. You can't study this book without developing or refining a taste for great

bench design and construction. Your worst headache will come from trying to decide which bench you like best. **The Taunton Press**; 63 South Main Street, Dept CC; Box 5506; Newtown, Connecticut 06470-5506.

I can't afford one of these, but if you can, and if your floor is sturdy enough, you're sure to love the hippopotamus of a commercially manufactured handloading bench called "The Rock." The manufacturer advertises it as "made of industrial-strength steel" and says, "it bolts to the floor and weighs a mere 354 pounds." The manufacturer also guarantees it "to be free of defects in materials and workmanship under normal use for the life of the owner."

Its special features include a high double shelf above the rear of the bench top, a built-in storage cabinet (below the top) that locks, adjustments to fit the bench to your taste and physique, and a matching steel stool. **Production Industries, Inc**; 240 Teller Street; Corona, California 91719; (800) 357-LOAD or (909) 272-0555.

Computer Software

Load Master includes a thoroughly tested assortment of handloads for (so far) fifteen handgun cartridges, using a wide variety of American and imported powders, with bullets cast in Magma bullet moulds. Other features include photographs of the listed pistol and revolver cartridges and Magma's portfolio of cast-bullet designs, a provision for you to enter your own handload data, and the ability to print all or selected loads. Based on DOS, Load Master also runs in Microsoft Windows. **Magma Engineering Company**; P O Box 161; Queen Creek, Arizona 85242; (602) 987-3301.

AutoCAD isn't the only good software for computer-assisted drafting and design (CAD). It's simply and unarguably the best I've seen. It's understandably expensive, since no CAD software with its depth, breadth, and precision can be simple. AutoCAD is to some extent overkill for designing cartridges — this relatively simple use of such a versatile program leaves most of its potential unused.

So wouldn't a simpler and therefore less expensive CAD program be a better choice for designing cartridges? I think not — because AutoCAD, and only AutoCAD, includes features available in no other CAD program I know of. So ironically, the cartridge designer uses not only the simplest features of AutoCAD but also some of its most erudite and advanced features, while most of its capabilities remain untapped.

AutoCAD is powerful, versatile, impressive — but shouldn't overwhelm anyone. If a computer hick like me can figure out enough of it to design cartridges with it, anybody else who can use a computer can learn enough of it to do well with it. The secret is to avoid trying to learn all of it to use a little of it. You wouldn't expect to take flying lessons in a Boeing 747 to enable you to fly a Piper J-3 or a Cessna 150. Check with **Autodesk, Inc**; 2320 Marinship Way; Sausalito, California 94965; (415) 332-2344; for the AutoCAD dealer in your neck of the woods.

Design & Drafting

James H Earle, *Engineering Design Graphics*. This university textbook for student engineers covers more about design and drafting than you'll ever want to know, but it makes clear what you want to know. **Creative Publishing Company**; Box 9292; College Station, Texas 77840; (409) 775-6047. Several other drafting books are available from this publisher, including *Basic Drafting*, *Creative Drafting*, *Drafting & Design*, *Drafting Fundamentals 1 & 2*, and *Technical Illustration*.

Gunwork & Tools

For consistently, dependably high quality in rifle barrels and chambers, I learned years ago — in too many instances the hard way — I had to pick barrel smiths carefully. Two of the best, still turning out good work, I'm delighted to consider good friends as well. The "and then some" grade of professional attitude, honesty, and workmanship we used to assume, expect, and take for granted still drives a few special individuals other than Paul Marquart and Tom Miller, but I don't know the others through their work and my own personal dealings with them.

Paul is simply the best cut-rifling man in the country, especially if you want an oversize barrel for custom milling (octagon or fluted, for example). He doesn't make barrels by the mile and

chop off two-foot lengths for blanks, either — every barrel is a custom project in every way: steels, twists, bore and groove diameters, barrel lengths, contours, crowns. He limits his output to a few calibers (7mm to .45) and makes a run of barrels in a given caliber only when he gets enough orders to make a tooling setup worth while. And he often delivers sooner than he promises, seldom or never later. **Marquart Precision Company**; P O Box 1740; Prescott, Arizona 86302; (602) 445-5646.

Tom Miller, custom gunsmith at Huntington's, doesn't make barrels but is one of the country's best smiths at fitting and chambering barrels. An added advantage to his enviably wide collection of special reamers is his handy next-door access to the RCBS custom-die shop, where he can arrange for the dies that best fit any chamber he reams. **Huntington's**; P O Box 991 (601 Oro Dam Boulevard); Oroville, California 95965; (916) 534-1210.

I haven't had Les Bauska (Kalispell, Montana), Dan Lilja (Plains, Montana), or Jim Baiar (Half Moon Rifle Shop; Columbia Falls, Montana) make barrels for me — but for a good many years now, I've heard impressively good reports from their satisfied customers. Considering the gloomy reports I've gotten on barrels from so many of the "big name" barrel-makers, I think these three are also worth checking out.

I haven't had any custom handgun work done in years 'n' years, so I'm not the bird to chirp melodiously about where to get a pet handgun tuned, modified, or salvaged. Sorry.

Gun Stocks

In The Good Old Days, I happily recommended several excellent stockmakers who had beautifully stocked several fine custom rifles for me. Great now is my sorrow, for I can now recommend only one stockmaker specifically by name — Jim Tucker; P O Box 15485; Sacramento, California 95815; (916) 923-0571.

Several of the others who did such fine work for me have since died. A couple of the others still alive have quit making gunstocks. I don't know what the others are doing now and have lost track of where they are, except for one stockmaker I can no longer recommend.

Although he is one of the best gunstock craftsmen in the lot, a man I used to recommend often and have featured in several magazine writeups and on a couple or more magazine covers, this man has turned out to be substantially less than honest and honorable. He has ripped me off for several hundreds of dollars worth of valuable custom hardware, some of it essentially irreplaceable, and I have had to apologize to several other riflemen who sent work to this man on my recommendation. I mistakenly assumed he was as honest as he was skillful.

For a list of able and ethical stock artists I can comfortably recommend in general, get the American Custom Gunmakers Guild's directory of services. The guild also includes several impressively able — and *honest* — metalcraftsmen. Typical guild members care a great deal about the quality of their work and the dignity of their reputations. I consider several ACGG members good friends but haven't had any of the current, living members of the guild do any metalwork or stockwork for me (except for the just-named Jim Tucker, of course).

The guild's *Gunmaker* magazine emphasizes ethics and good business practices, and the guild's active ethics committee tries with some success to keep guild members ever mindful of how to be honest with their clients. Regrettably, only the members and a few honored friends of the guild can get *Gunmaker* — but if you become an associate member of the guild, you'll soon develop a sense for quality gunwork and a clear idea who can deliver high quality honestly and dependably. And I guarantee you'll enjoy the *Gunmaker* photographs of stunningly grand gun work by the members of the guild. **American Custom Gunmakers Guild**; P O Box 812; Burlington, Iowa 52601-0812; (319) 752-6114.

Chapter 8

The rest is yet to come.

THERE'S MORE to come — as soon as I can get it done. The International Cartridge Archives projects — primarily, the *Custom Cartridges* books and a computer database of cartridge dimensions — are continuing endeavors. Other books and related reference publications may come later, but these have to come first.

Custom Cartridges, Volume Two

Volume Two of this work will include dimensioned drawings of cartridges not included in Volume One. The drawings in this volume, only a small sample of the thousands of known cartridges, are just the ones I've been able to draw from authoritative dimension data. The drawings and specifications for other cartridges will come to light as this work becomes widely known, and I'll draw them for Volume Two as they come in.

Volume Two will also probably include drawings of a few cartridges that I've already included in Volume One —

- if I get authoritative, dependable corrections of errors I've made in the drawings in Volume One
- if I get better data for some of the drawings I've based on sources less than the most reliable — from unidentified drawings and from specimen cartridges, for example
- if some cartridge authorities (*e g*, SAAMI) change some of their maximum dimensions

Volume Two may also include a number of dimensioned chamber and reamer drawings, for cartridges I've been unable to document with reliable cartridge drawings. I have a frustrating number of reamer and chamber drawings already — frustrating because all the drawings in my books are meant to be *cartridge* drawings, and I haven't been able to discover any consistent correlation between maximum cartridges and minimum chambers.

I assume that reamer drawings specify dimensions somewhat larger than the corresponding dimensions for their minimum chambers, since a reamer's dimensions should allow for a resharpening or two before the reamer wears down until it becomes too small to ream a minimum chamber.

If I can't get good dimension data for the cartridges that I can now document only by their reamer and chamber dimensions, Volume Two may have to include a few reamer and chamber drawings, not just cartridge drawings.

The text chapters in Volume Two will focus on loading and testing custom cartridges. But there won't be any load data in Volume Two, either. The enormous number of cartridges to be included in both volumes makes the compiling of load data for even a significant number of them far too costly in time and outlay, even if it were possible to accumulate all the firearms and

loading dies for so many cartridges into one collection. Volume Two will focus instead on the special equipment and techniques of advanced and experimental handloading.

Advanced and experimental handloading become necessary whenever you have to go beyond recipe handloading — no longer rotely copying loads lifted out of loading manuals and magazine articles. Several basic categories of cartridges require experimental handloading:

¤ known loads for familiar cartridges (factory and wildcat), to be tested for safety and their relative performance
¤ experimental and unproven loads for familiar cartridges
¤ experimental loads for obsolete or exotic cartridges not included in loading manuals or magazine articles
¤ experimental loads for new cartridges — your own or others' cartridges
¤ experimental loads, in any cartridge, for testing specific components

One long chapter ("Burning the Midnight Powder") will comprise my detailed reviews of all the computer ballistics programs I can acquire and try out on my IBM-system computer (with whichever version of MS DOS is current and maybe OS/2).

I have about eight to ten of these ballistics programs already and am eager to get into them deeper than I've been. Each seems to offer or emphasize some feature not included in the others, so *Which one's best?* is probably a question without any single answer. This chapter will help you decide which one you're likely to prefer.

The second volume will also include comments on facilities and equipment for test shooting — benches, targets, chronographs, and the rest. And since the most reliable and productive experiments depend heavily on good records, the second volume will cover how to keep the load and performance records that make your experiments worth more than they cost you in time, thought, and dollars.

The ICA Cartridge Database

The International Cartridge Archives database of cartridge dimensions is a computer compilation of essentially the same information in the cartridge drawings in both volumes of *Custom Cartridges*. The database is just cartridge dimensions — no drawings, and still (sorry!) no load data. In its present form, it comprises dimension data on about 5,600 cartridges — most of which range from incomplete through questionable to flat wrong. When *Custom Cartridges*, Volume Two, is ready for printing and binding, the process of confirming, correcting, and extending the database of cartridge dimensions will rise to top priority.

The dimension data in this computer resource will be available through at least two channels: by consulting The International Cartridge Archives directly, and by purchasing a licensed copy of the entire database. The database will someday be available, compressed, on floppy discs (now please don't "correct" me — *d, i, s, c* is the original, correct spelling), on compact disc (CD ROM), or in both formats.

Design Service

The Archives also offers design assistance to help you design your own cartridge (assuming it's not already available in a similar or identical design) or to design a cartridge for you. Several cartridges in this volume are custom-designed. Call the director for details of this service.

The International Cartridge Archives

The International Cartridge Archives is a loose association of cartridge enthusiasts with no charter, no dues, no organization, no member benefits except fellowship and a shared purpose, a simple agenda, and a simpler "constitution." What connects us is the single desire to make dependable cartridge information clear and available to anyone with a legitimate interest (assassins, antigunners, and similarly sorry scoundrels need not apply).

Everyone who contributes somehow to the Archives' purpose is a member as long as he wants to be one of us. We're compiling all the cartridge information we can get — cartridge and chamber drawings, tables, specifications, dimensions, notes, and miscellany — to preserve, organize, clarify, and present dependable data for easy reference.

The temporary "headquarters" of the Arch-

ives (not a lot more than a head and a few quarters, right now) will for the indefinite future remain crammed into the director's little temporary home in Stevensville, Montana. Plans for roomier, quieter facilities with an instrumented test-shooting range and maybe even a shooting tunnel remain unfulfilled but will not be soon forgotten or forsaken.

The rest is yet to come.

Stay tuned.

VOLUME ONE • THE END •

Index to the Cartridge Drawings